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Engineering News-Record

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Calumet Drainage Ditch Reverses River Flow

By Ray D. Hammons

How We Organize and Plan Big Building

By L. J. Horowitz

Flood Damages Power Plant in Jamaica

By F. L. Bronstroph

Waterless Gasholders: A New Type Introduced Into American Practice

Waterless Gasholder of 1,000,000-Cu. Ft. Capacity at Michigan City, Indiana

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ENGINEERING NEWS-RECORD

McGraw-Hill Company, Inc.
JAMES H. McGRAW, *President*
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DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

FRANK C. WIGHT
Editor

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Killing Time

CALVIN COOLIDGE left the White House to ride to his inaugural on March 4 just before 11 o'clock in the morning. A photograph showing him on his way was in San Francisco a half hour earlier by the clock, and newspapers carrying the picture were being sold to San Franciscans before the President had finished his inaugural address. Telephonic transmission of photographs is the latest of the wonders of science to be set before the jaded modern. We take these things calmly, now. It is only when we annihilate time and beat the sun in his accustomed round that we realize how fast we move into the realm of the impossible.

Spotlighting Engineering Problems

ONCE a year the Western Society of Engineers holds a two-day midwinter convocation to discuss some civic problem that has an engineering slant. This year "Planning Chicago's Development" was the subject, with the idea that engineers could well emphasize all of the material elements which determine the successful growth of the city into an industrial metropolis so as to serve the needs of the people, their property, health and happiness. Especial care was taken to stress those problems which are in a critical stage, and demand immediate recognition and prompt action. Sewage disposal and water supply, local transportation and rail and water terminals, all of which require advance thinking and planning so that the public interests may be safeguarded, had a leading place. The convocation is a good thing for Chicago and the engineers. Both benefit. Those citizens who read the newspapers get some sensible disinterested thinking on the city's most vital problems. The engineers are broadened and made more cognizant of their civic responsibility.

General Contractors' Service

FEW construction operations exemplify the co-ordinating function of the general contractor so clearly as does big building. Requiring from three to half a score special trades acting in conjunction under subcontracts, big building demands the extreme in timing construction. The general contractor's organization, then, is predicated upon giving chiefly this service. He may do, and usually does, a considerable volume and variety of actual construction, but this only extends his chief task which is to time and interlock all operations so that the total accomplishment desired is quickest arrived at. It is such an organization that is discussed in the article by L. J. Horowitz in this issue. As the executive head of a large building contracting firm he writes with authority. Valuable as his presentation of a specific example may be, however, the article has outstanding importance as a demonstration of a necessary function in construction which the general contractor has—the function of responsible organizer. There is need for engineers and owners to hold to this fact. Constant pressure is being brought on them to contract separately for heating and plumbing and wiring, for plastering and painting and other work. It may be done, indeed it often is done, but in every instance unless construction chaos or unendurable delay is to follow, some one, either the owner or his engineer or architect agent, must assume the responsible managing function which the general contractor assumes. And it is not a small obligation and responsibility.

Professional Incapacity

THE bill to combine the public works functions of the federal government was only one of the many on which the late Congress failed to take action. It is probable that no matter what effort had been expended by the construction interests of the country the result would have been the same, for Congress was in no mood to legislate, but if it had been favorably inclined toward the so-called Department of Public Works legislation it would have had little help in its thinking from those who might be supposed to be most concerned, the engineers and builders of the country. It is true that there was an organized effort made to promote the Public Works Department idea, but this organization, with representation from engineers, architects and contractors, could not agree to support the legislative bill, partly because of the omission therefrom of the severance of river and harbor work from military control, but more particularly because the architects insisted that there be an Assistant Secretary of Architecture as well as the one of Public Works provided in the bill, whereupon the contractors, as a *reductio ad absurdum* demanded an Assistant Secretary of Construction. Who was to decide the relative jurisdictions of these three interlocking gentlemen, no one has yet explained. It is clear, though, that unless the representatives of the construction field can offer better co-operation and clearer thinking than this that Congress will quite justifiably continue to let federal construction be directed by politicians.

What We Have We Hold

QUEBEC has stream flow sufficient to develop some fifteen million horsepower, although only a little over a million is now being generated. Some of this million goes across the international boundary line and there is a demand for much more. Capital is ready to develop some of the unused power, but the demand in Canada itself is not great enough to warrant any great increase and capital is naturally reluctant to spend the money in the hope of developing a domestic market. Now comes Premier Taschereau, of Quebec, with an announced policy of restricting further export, on the ground that Quebec must keep its own for its own upbuilding and that contracts once made for power exportation are practically impossible to abrogate. In other words he fears that energy once sent across the line will build up for itself so secure a demand that nothing short of international conflict will serve to

divert it back to domestic use if it ever becomes necessary at home. Whatever be the patriotic ends the premier may have in view—and we do not for a moment question them—he is taking a curiously narrow view of the economic development of nations. It is pretty generally accepted that no man can live to himself alone. A like rule applies to nations. When that which they need is insignificant they can afford to put an embargo or a high cost on that which they make and other nations need, but when they are dependent on other nations for their necessities it is dangerous indeed, economically, to invite reprisals. But aside from that, where does Mr. Tascherau get the idea that this country will insist on a continuance of the sale of energy, or any other product, beyond the period set in the contract when the product is sold? And can Quebec insure a power production at that future time when it can use it better than by making a foreign country pay for its establishment and carrying it during the time when Quebec is moving toward its complete use?

Concrete Crack Fillers

CRACK fillers for concrete roads still call for research. Two lines of endeavor appear to interest practical road builders. One is to secure a filler which will have the color of the pavement and so camouflage as well as possible evidences of failure. The other is to secure a filler which will stick, and it is by all odds the more important. The latest completed records of crack-filler experiments come from Iowa. Altogether fourteen bituminous mixtures were tried. They were all mixtures from which, in the nature of things, success might be anticipated, but of the fourteen only three stuck. The others separated from the sides of the cracks and peeled from the surface and largely or completely disappeared from the road. Of fourteen mixtures, eleven were failures. Those who are interested in the details will find them in the forthcoming report of the Highway Research Council, the conclusion of whose special committee was that "some practical method for making asphalt stick to the pavement should be devised if possible." Other tests are now in progress in Michigan which may give us the desired method, but there remains in this major operation of concrete pavement upkeep an opportunity for some very profitable investigation.

A Change in Old Practice

AN INNOVATION of revolutionary character is represented by the introduction of the waterless gasholder described in this issue. The new holder represents the first basic change in practice in its field for more than a century. The bell type came into use with the early days of illuminating gas, and has continued in exclusive use ever since, merely developed by the application of multiple lifts, the design of improved supporting structure, and application to large sizes. The piston type of holder thus brings a complete change. The rising bell is replaced by a fixed shell, and simultaneously the guide frame is eliminated; the gas is stored in a fixed tank just like water, though necessarily a movable piston is used to bound its upper surface. The transformation saves a large item of weight, and in many cases an even larger item in foundation cost. Presumably it is these advantages that facilitated the introduction of the holder. Already two have been completed, and a third one is soon to be built. The latter, of 15,000,000 cu.ft. capacity, will equal the largest bell holders in existence. Its diameter of about 250 ft. and height of 330 ft. characterizes it as a structure of such formidable proportions that its success will settle all question as to the relative place of the two types. That such rapid progress could be made by an innovation as radical as the present one is due in part to the fact that the piston holder has undergone gradual development during a dozen or so years in Germany, where the type was invented. But it seems clear that much credit must also go to the American builders, for their energy and care in working out the problems of design and construction, and perhaps still more for their enterprise in selling the new holders. On its present showing and on the face of the figures, the piston type holder is due for extensive application. Moreover, in addition to economy in material it may prove to have advantages on the score of esthetics and safety that will recommend it to the favor of the public, which by and large has never been willing to recognize the old-type gasholder as an agreeable neighbor.

Standardization by Averaging

IN THE announcement, just issued by the American Engineering Standards Committee, that a sectional committee on the standardization of manhole frames and covers is to be organized, there is brought out an interesting variation in the objective of standardization. A great deal of standardization represents mainly the elimination of commercial diversity, either by bringing the views of producer and consumer into harmony, or by wiping out a needless diversity of commercial manufacturing schedules that serves no particular need and represents no particular opposition of view. Street manhole standardization is essentially different. It is true that some measure of elimination of commercial diversity is involved; but the controlling feature is the fact that at present the required strength of manhole covers to withstand normal service is not definitely known or agreed on. The service cannot be defined a priori in terms of load or calculated stress; in fact it is not capable of direct expression at all. It can only be stated in terms of manhole cover design, and this must be developed empirically from the general experience of a body of engineers who have been concerned with the subject and have from this experience formed a judgment as to the dimensions and proportions which will resist normal service effectively and without undue expenditure of material. It will doubtless result from such an averaging of experience that the most severe conceivable service will not be provided for by a standard adapted for general use. Perfection cannot economically be provided in such matters; but even the degree of perfection that it is desirable to attain will be a matter of difference of view, and this in itself will be a factor in the averaging process. A real gain can be accomplished through this standardization. There are many applications of the same procedure, and many opportunities for good results to be obtained from it. There are limits beyond which it can not go without invading the proper field of individual skill and judgment in engineering design. Technical standardization when carried beyond these limits is abortive and injurious. Within its proper field it is highly constructive and constitutes a valuable public service.

Apprenticeship for Civil Engineers

THERE has been a great deal of discussion the last few years on apprenticeship in the building trades, and coincidentally there has been running in entirely different circles a discussion on the faults and necessities in engineering education. Few have thought to join the two discussions together to the extent of querying how far apprenticeship might be extended into civil engineering education until a committee of the Engineering Institute of Canada this year embodied such a thought in its annual report.

Apprenticeship in Great Britain has long standing in the profession of engineering. An outgrowth of the indenture system of the trades, it is in effect the major method of producing professional engineers in the British Empire. The committee of the Canadian Institute by training and heredity is naturally influenced by British practice and its report therefore is colored by the experience of British engineers. The committee on the contrary is sufficiently North American in its viewpoint to magnify more than do the insular British the value of university engineering training, for it has thought to suggest the possibility of combining with that university training the advantages of the apprentice system. In essence, it reports that "for civil engineers at least two years spent on the staff of a chief engineer or contractor on large public work, with or without pay, so long as the employer recognizes his responsibility and gives the young engineer all reasonable opportunities to gain experience, is probably the best form of practical training that the young engineer could have, as, if the works are sufficiently large and the apprentice sufficiently keen on acquiring knowledge, he will learn more in a month of the actual difficulties of engineering and construction and how to overcome them than he would in years of study without practical experience."

Some may find difficulty in distinguishing wherein this suggestion offers any change from current American practice. The distinction is there, however, in the recognition of the mutual obligation between employer and employee that apprenticeship involves. The apprentice agrees to work for a small sum for a fixed period of years, with the avowed purpose of learning practical details. The employer, on his part, agrees to regard the apprentice more as a pupil and a learner than as a producer. His obligation is to his craft or his profession in the bettering of the man power of that craft or profession. The distinction between the apprentice and the young employee is quite clear, because the latter, in engineering work at least, is obligated to furnish his employer a return in actual production and expects from his employer, on the other hand, no advantages of distributed activity for a better learning of the details of practical work. In civil engineering practice in this country the young graduate as a rule has to become an employee, with the full obligation for services to be rendered that any employee has. If he is to learn the practical details of engineering, as learn he must if he is to become a real engineer, he must learn them as a part of his daily job. There is rarely, if ever, the idea of any mutual obligation as a result of which a rounded member is added to the engineering profession.

The British system of engineering education does not include in the college curriculum anywhere near as much practical material as does the American system. The young engineer, therefore, must get everything except his theory in his apprenticeship period. In this country probably we are not yet ready to admit the entire validity of the frequently made claim that engineering education should have removed from it all of the practical and be made entirely theoretical, but we could emphasize somewhat more of the theoretical and discard some of the practical in schools if we were sure that the graduate would continue his education process in the year or two out of college, rather than as is now generally the case to set immediately onto some specialized piece of design or construction as a full fledged professional and expert.

It is obvious that the difficulties of making so radical a change in our system of post-college education are great. The engineer-employer is not yet willing, as a rule, to contribute his share in such a scheme. The embryo engineer is not yet ready to put in the diversified labor that an apprentice must at the low wage that an apprentice can hope to receive. The scheme, however, works in many of our mechanical engineering branches, particularly under the auspices of some of our large mechanical engineering manufacturers, and its possibilities for civil engineering are at least possibilities. The committee of the Society for the Promotion of Engineering Education on engineering education might well devote some study to the problem.

Chicago Gets a Reprieve

SECRETARY WEEKS' order on the Chicago Drainage Canal diversion is a circumspect document. It goes just as far in authority as the law allows and no further, and in so doing it only postpones the settlement of the problem. Chicago for the next five years has the use of approximately 10,000 sec.-ft. of the waters of Lake Michigan provided she does several things, some of which she has already signified her intention of doing and others of which she has refused hitherto to do. The enforced sewage purification program, for instance, is the program already announced by Chicago, and the required bond for participation in lake control was long ago offered, but the control works in the river have been opposed by the drainage district and the city has consistently refused to install the metering that the government now insists upon as a prerequisite to the diversion permit. If the recent Supreme Court decision means anything at all, however, the Secretary of War's order is mandatory and Chicago, as a drainage district and as a city, has no recourse but to obey—unless there are still further ramifications of the law's delay in the portfolios of her legal advisors.

It is significant that the latest order takes no notice whatever of the claims of the Illinois waterway or of the downstream power demands. These, of course, are outside the statutory authority of the Secretary of War. But in ignoring them the secretary apparently had to conclude that the sanitation of the district will not perpetually require the full demanded flow down the Chicago River, for the endorsement to the order specifically "looks to a reduction to 4167 sec.-ft. by 1935." The War Department thereby announces its disbelief in Chicago's claims that, sewage treatment or no sewage treatment, 10,000 sec.-ft. is necessary. If Chicago is to maintain that view its relief now seems to be only in Congress—with the further barrier of constitutionality to be surmounted later.

How We Organize and Plan Big Building Operations

Explains the Administrative Organization of a Large Building Company and the Method of Planning Its Major Operations

By L. J. Horowitz
President, Thompson-Starrett Co., New York, N. Y.

THE EFFECTIVE control of large building operations would be chaos without two things: Organization and Planning. This article describes the functional organization of the general staff of one concern, how it plans, co-ordinates and executes its contracts. Fig. 1 is the organization chart.

The staff is organized horizontally rather than vertically, as this company's experience is that the horizontal plan has important advantages. Each department is in charge of a specialist. He is an expert in his work and concerns himself only with his own department and its clearly defined relations with certain other departments. Starting at the top of the chart the activities and general policies of the firm, as a whole, are controlled by the finance committee acting through the president, who is the chief executive of the company. He is chairman of the administration committee. Branch offices and promotion are under the direction of other officers of the company, who are, of course, responsible to the president and the finance committee.

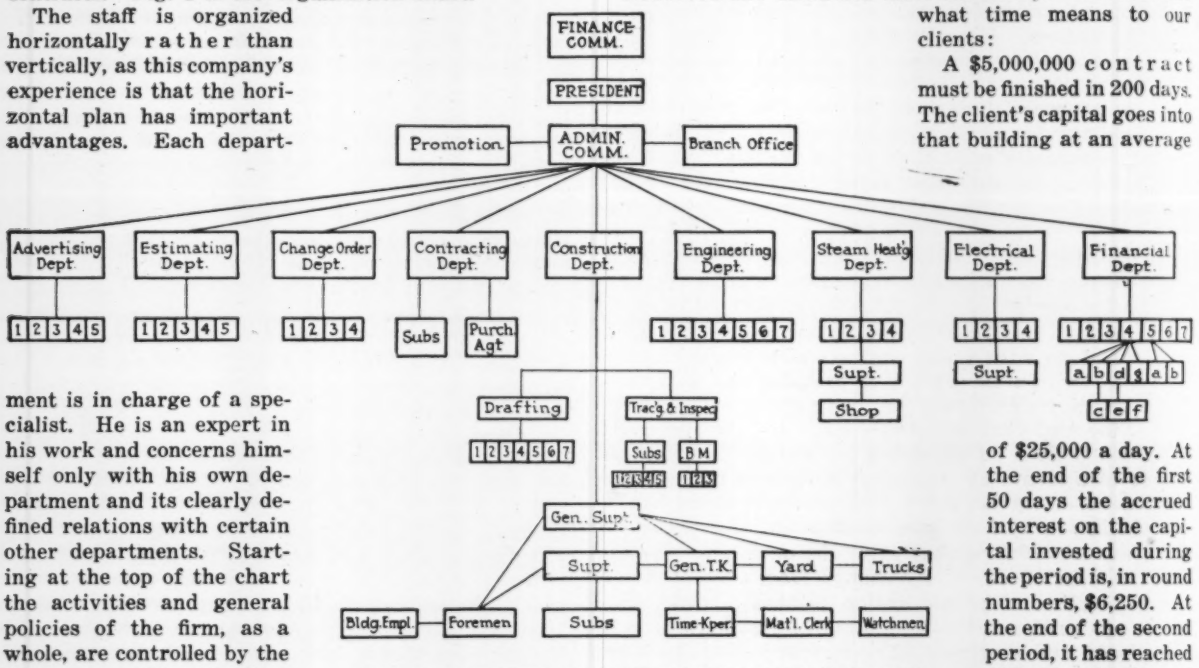


FIG. 1—ADMINISTRATION ORGANIZED HORIZONTALLY

The proper functioning of a horizontal organization is wholly dependent upon establishing formal means and methods of transacting business *between* departments, and, above all, establishing a permanent clearing house for the frequent exchange of inter-departmental information, and for taking definite and immediate action thereon. The Administration Committee performs these important duties. It is the tie between all the working departments and is the executive body as well. Its members are the heads of all the departments and its chairman is the president of the company. It meets every week. Stenographic notes of each meeting are transcribed and bound the same day ready for immediate reference. I cannot too strongly emphasize the importance of this weekly executive session. There, each department reports its progress and its needs; plans are promulgated, orders issued, responsibility placed, emergency measures initiated. Lost motion is taken up at once, and any indefiniteness is eliminated.

Committee Works Against Time—Of the three elements which enter into correct building construction—time, quality, and economy—time is of the first importance. The others will follow naturally if time is conserved and disbursed most effectively. To illustrate what time means to our clients:

A $5,000,000 contract must be finished in 200 days. The client's capital goes into that building at an average of $25,000 a day. At the end of the first 50 days the accrued interest on the capital invested during the period is, in round numbers, $6,250. At the end of the second period, it has reached $25,000. At the end of the third, $56,250 and at the end of the fourth $100,000. (A period is taken as two calendar months, and annual interest at 6 per cent.) Thus the cost to the owner of a lost day grows rapidly with the progress of construction. At the same time the liability to delay increases as the work in hand becomes more and more complex and the strain on the organization of the job approaches its maximum. If the organization breaks, the job may be strung out indefinitely—to the common loss of both owner and contractor.

Every function, therefore, of the administration committee is bent toward time-saving, toward rigid adherence to the time-table drawn up for the job by the planning department. Excuses are ruled out on the principle that "the better the excuse, the worse the reason." Each member of the committee has his duties put squarely up to him by the tables of organization. If he is being hindered in any way in prosecuting his work, he says so at the next weekly meeting, and the cause is isolated and remedied at once.

The modus operandi of the committee can best be explained by describing the departmental organization. There are nine departments: (1) Advertising. (2)

Estimating and Planning. (3) Change Order. (4) Contracting. (5) Construction. (6) Engineering. (7) Steam Heating. (8) Electrical. (9) Financial. The duties of each may be summarized for clarity as isolated or intra-departmental, and interlocking or inter-departmental.

Advertising—The advertising department needs but little mention as its duties are obviously those of any publicity section, and are regulated by the directing policy of the company.

Estimating—The estimating department is charged with these duties:

Isolated:

a. Prepare estimates on new work including the quantity survey, prices, sub-bids, etc.
b. Arrange for signing contract plans and specifications for and by the owner.
c. Prepare statistics of unit prices and time of execution of completed jobs using the working estimates, cost sheets and job diary as a basis.

Interlocking:

a. After a contract has been awarded, prepare the working estimate, a standard detail of all labor, material and sub-contracts, arranged to agree with the cost sheets; copies go to construction, change-order and financial departments.
b. Prepare schedule of contracts as the basis for requisitions upon the owner; copies go to financial department and owner.
c. Price the digest of items in each sub-contract prepared by the drafting department.
d. Prepare the time schedules for the job, one graphic and one descriptive.
e. Supervise the preparation of weekly cost report, showing in parallel columns estimated and actual costs, etc., in consultation with financial department. Forward weekly cost report to construction department.

Change Order—Changes are the bugbear of construction. Unless they are systematically handled they lead to disorganization, waste and consequent loss. Changes originate through (a) the discovery in the drafting room of discrepancies between the general drawings and details, (b) violations of ordinances, (c) revisions, (d) unusual conditions at the site, and (e) owners' orders. The change-order department has been created to handle these and thus relieve other departments of the burden and responsibility. All its duties are necessarily interlocking:

a. Send out request for estimate to the heads of departments and sub-contractors affected and the superintendent at the building.
b. Prepare an estimate of cost.
c. Submit to the owner for authorization.
d. Send out order to proceed or notice of abandonment, same routing as (a).
e. Keep card record of changes contemplated, authorized and to be executed by sub-contractors or by selves.

Contracting—The contracting department is charged with the award of all sub-contracts except foundations, steel, heating, ventilating and wiring; and with the purchase of all material. All its duties are interlocking:

a. Award sub-contracts, using as a basis the bids taken and forwarded by the estimating department and the contract digest from the drafting room.
b. Secure owner's approval of sub-contracts.
c. Notify all department heads of sub-contract awards.
d. Have contracts signed and copies sent to financial and drafting departments, sub-contractor, and the superintendent at the building.
e. Send purchasing agent a digest of all material to be bought by him.

The duties of the purchasing agent are:

a. Purchase all bulk materials, submitting samples for approval as provided, under the supervision of the head of the contracting department.
b. Take charge of all plant, equipment and yards, of movements, issue and purchase.
c. Purchase and issue job and office supplies subject to the approval of the financial department.
d. Keep purchase data records.

Construction—The Construction Department includes the drafting room, tracing and inspection department, and the whole field organization. The last named may be briefly dealt with here, since we are chiefly concerned with administration. The department's duties are:

Isolated:

a. Creation and control of the field organization, through the general superintendent who is the liaison officer between jobs and the office. Each job is in charge of a superintendent.

Interlocking:

Drafting Room Duties:

a. Prepare the digest of all labor, material and sub-contracts as already described.
b. Take charge of all work connected with drawings, details and prints.
c. Interpret drawings in detail.
d. Receive notices of violations of ordinances and refer to the engineering department for action and to the change-order department if an expenditure is involved.
e. Prepare a schedule of all certificates, policies and guarantees and secure same, properly disposing of them.

Tracing and Inspection Department Duties:

a. Secure from the sub-committee a schedule of dates of shipment of material and follow them up.
b. Prepare analysis of operations in the shops of each sub-contractor, and set dates for completion of each to insure a delivery by the date called for in the time schedule.
c. keep a record of shipments and arrivals, ordering all unloading and hauling to be done promptly.
d. Approve sub-contractors' requisitions for payment in accordance with the digest of labor and material, prepared by the drafting department and priced by the estimating department. Forward the approved requisition to the financial department for payment.

Engineering, Steam Heating and Electrical—These departments are purely technical. The engineering department deals with the design and construction of foundations and steel structures; the steam heating department with steam power and heating plants; and the electrical department with light and power wiring, and with the generation and transmission of electricity.

They function as supplements to the contracting department and in the same manner; subletting work and placing contracts for material. They requisition from their own stock which is replenished through their purchasing agent. The steam heating and electrical departments have their own superintendents, and the former operates a pipe shop. They are maintained as self-contained units, partly because of their technical nature and partly because they can contract for work in their lines independently of the other departments.

Financial—The financial department handles the general books, cost-accounting, billing, and the receipt and disbursement of cash.

Since the administration committee includes the head of each of the departments, it is the concentration center of the responsibility for all phases of the business; and its executive function represents the co-ordinated effort of the entire organization. It would be

tedious to describe the paper mechanism by which inter-departmental business is transacted. A great deal of it is eliminated by the personal contact of the weekly meetings of the committee. Possibly a single instance of paper work will serve as a general illustration.

Planning—Time being the important element in construction, it follows that the time schedule prepared by the estimating department is the backbone of all other planning essential to the expeditious completion of the work. A typical time schedule is shown in Fig. 2. The listing of the numbered divisions is standard. The three columns to the left affect the office activities only. They contain respectively: (a) The date when enough drawings must be on hand to enable the sub-contractor to submit his final estimate, (b) the date by which the sub-contract must be let or the orders for bulk material placed, and (c) the date by which all detailed drawings must be in the sub-contractors' hands. The two columns to the right show the dates when each division of the work must start and finish, in the field. To assist the field organization, these are usually plotted graphically as shown in Fig. 3.

It is obvious that the time allowed for any class of work, as brickwork, varies considerably with the kind of brick, the bond used, the joint, etc. Here the statistical record of past performances kept by the estimating department furnishes the requisite data. The allowance made for any work must be reasonable but not too generous. Naturally it depends to a great extent upon the number of mechanics employed, although there is a saturation point in this, beyond which loss of efficiency begins.

The dove-tailing of the branches of the work done by the contractor's own force is comparatively easy since he is in full control. But the maintenance of the time schedule depends also upon the delivery at the

TIME SCHEDULE, THOMPSON-STARRETT CO.

Class: *Office Bldg.* Building — Office Schedule

No. Story: 22 Plus 3 A. Typ. No. — Date: 2-4-24 — Job Schedule

Drawings to let contract	Contracts must be let by	All details for sub-contractor		Work	Start	Finish
2-4-24			1	Steel Drawings		
"			2	Architects Drawings		
			3	Wrecking		
2-13-24	2-28-24	3-13-24	4	General Excavation	4-4-24	5-4-24
"	"	"	5	Core	8-13-24	11-13-24
"	"	"	6	Caissons	4-18-24	6-4-24
"	"	"	7	Foundations, Concrete	6-23-24	9-18-24
"	"	"	8	Walls to Grade	"	"
"	"	"	9	Waterproof, Walls	"	"
"	"	"	10	Grillage, Steel to Grade	5-13-24	7-4-24
"	"	"	11	Steel Erection, above Grade	7-4-24	10-18-24
3-18-24	4-4-24	4-18-24	12	Ornam. Iron Stairs, Plain	7-4-24	
"	"	"	13	" " Finish		3-1-25
4-4-24	4-18-24	5-4-24	14	Elevators; Guides, Temp. Car	8-4-24	
"	"	"	15	" Car, Signal, Test		3-4-25
3-18-24	4-4-24	4-18-24	16	Boilers; Temp. Heat	11-4-24	2-4-25
"	"	"	17	Pumps, Tanks	12-4-24	3-4-25
4-4-24	4-18-24	5-4-24	18	Arches	6-4-24	11-4-24
3-18-24	4-4-24	4-18-24	19	Plumbing; Gas: Rough, Test	7-4-24	12-23-24
"	"		20	" ; Finish; Fixtures		3-4-24
"			21	Heating		

FIG. 2—SAMPLE OF TIME SCHEDULE

proper period and in correct quantities of the material ordered by the purchasing agent. Consequently he, too, in placing his order, works on a delivery schedule based on the general time schedule. As storage space in a building under construction is limited, the delivery schedule must be closely followed. An interruption may leave expensive mechanics without enough to do—a fatal condition when lay-offs are out of the question. The inspectors and tracers, therefore, visit the material yards, check and trace each shipment and see to its delivery. The department pursues the same course in following up the shop and field work of the many sub-contractors—a more difficult task and the neglect of which may disorganize the entire schedule. The head

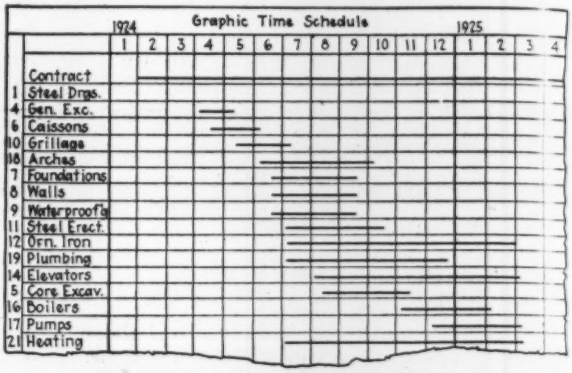


FIG. 3—GRAPHIC TIME SCHEDULE FOR FIELD USE

of the department, therefore, has wide power to enforce compliance with delivery orders.

One of the most important duties of the general superintendent, in his visits to the various jobs, is to observe how the schedule is operating and to anticipate general needs.

As the drafting department is charged with obtaining the architect's details on time, and with the preparation of its own drawings, the entire system of follow-up for the field work, namely, the drafting, tracing and inspection and general superintendent's departments, are responsible directly to a single authority, the general manager of the company.

The effectiveness of the planning system is insured by the prompt action taken upon all delays, existent or anticipated, at the weekly meeting of the administration committee. There is no opportunity for anyone, in or out of the organization, to "pass the buck," since all responsible authorities are present. The committee also decides the proper pressure to apply to recalcitrant sub-contractors or others not on the company's direct payroll. Furthermore, acting on the principle that co-operation is at least as effectual as pressure, the committee concerns itself with devising ways and means of *assisting* the sub-contractors and material supply firms to live up to their part of the schedule. This may take the form of securing sources of raw material for them, of aiding them in its fabrication, arranging transportation facilities and routings, and, in general, placing the company's resources at their disposal.

While the time schedule is as rigidly enforced as a railroad timetable, situations are sure to develop in which its maintenance becomes extremely difficult. Among the common causes of delay are: slowness in deciding upon important elements in the design of the building, abnormal weather conditions, steel delivery, strikes, failure of sub-contractors and the inevitable changes. Sometimes the most extraordinary efforts must be made to overcome these obstacles. Last year a New York builder, whose largest contract was tied up because he could not get cars enough to keep steel coming, went out into the market and bought ten old flat-cars, conditioned them and freighted his own steel from the mill.

Insuring promptness of action in the building as in many other fields requires that reliance upon others be

reduced to a minimum. The builder of important structures must have his own transportation, machinery and equipment. He must go back to the source for his materials, i.e., to the manufacturer. Finally he must be organized to do as much of the work with his own force as possible. Our organization executes about 60 per cent of the work, subletting the other 40 per cent.

The time schedule, then, is the controlling factor in planning the work. It originates in the estimating department as do the other three documents necessary to enable other departments to plan their operations. The four control schedules are: (a) Time schedule; (b) working estimate; (c) schedule of contracts; and (d) digest of inclusions in sub-contracts. The part which each plays in the general and departmental plan is indicated in the scheme of distribution:

Time Schedule—

1. To all department heads and the superintendent.
2. To the contract department. (a) To award sub-contracts by the scheduled time, (b) to enable the purchasing agent to plan his schedule of quantities and delivery dates.
3. To the construction department, (a) so that the drafting room may obtain, by the assigned dates, the architect's drawings and sub-contractor's shop drawings; and to have the designated drawings signed; (b) so the inspectors may follow the progress of shop work, shipments and delivery; (c) so that the field superintendent may plan his work.

Working Estimate—

1. To the estimating department to form the first column of the cost sheet.
2. To the construction department as a guide to field costs.
3. To the contracting department as a guide to the amounts allowed for purchases and sub-contracts.
4. To the change-order department as a basis for estimating the cost of changes.

Schedule of Contracts—

1. To the owner or architect for approval.
2. To the financial department for record.

Digest of Inclusions in Sub-Contracts—

1. To the tracing and inspection department as a bill of material whose production is to be checked.
2. To the financial department as a basis for payment.

Each department concerned is thereby put in possession of full information of the time and money limitations for all parts of the job, as well as the names of all co-operating agents and the nature and detail of the work to be performed by each. The department is then expected to plan its own work in conformity with the general scheme, and is held accountable for performance accordingly. Of course the intra-departmental system is developed and standardized. The financial section, for instance, has a highly refined system of cost accounting. And the construction section has an elaborately worked-out system of planning the distribution and handling of materials, the employment and control of labor, the sequence of operations, the use of mechanical plant and all that makes for construction efficiency. But these are studies in themselves, the present aim being only to explain the administrative organization of a large building company, and the method of planning its major operations.

Alaska R.R. Revenue and Expenses

Expenses for the operation and maintenance of the Alaska R.R. during the next fiscal year will be $2,605,000, it is estimated. The revenues will be $1,000,000. The deficit for the current fiscal year will be $1,500,000.

New Mexico-Colorado Water Compact Ratified by Congress

THE WATER compact between the states of New Mexico and Colorado concerning the waters of the La Plata River, ratified by Congress during January and signed by President Coolidge on Jan. 29, as noted in *Engineering News-Record*, p. 319, Feb. 19, is the first water treaty involving western rivers, to receive Congressional ratification. The compact now becomes operative and waters of the La Plata River will be distributed during the irrigation season of 1925.

The La Plata River, a small tributary of the San Juan River, rises in the La Plata Mountains in Colorado, just west of Durango and enters the San Juan River in New Mexico just west of Farmington. It has a runoff of 70,000 acre-ft. per year, 85 per cent originating in Colorado. The present consumption in both states approximates 30,000 acre-ft. from the irrigation of 23,000 acres, 4,000 acres in New Mexico and 19,000 acres in Colorado.

The undeveloped irrigable area in the La Plata Basin approximates 50,000 acres located chiefly in Colorado. Expansion of the irrigated area depends upon construction of reservoirs, chiefly in Colorado.

In substance, the compact provides for a flow of 100 sec.-ft. at the Colorado-New Mexico line during the period of snow runoff (flood season). As the river declines during the summer, the flow at the state line must equal one-half of the mountain runoff at the head of the irrigated area near Hesperus, Colo. Administration is placed in the hands of the state engineers of New Mexico and Colorado.

STATUS OF INTERSTATE WATER COMPACTS

River	*States Affected*	*Status*
La Plata	New Mexico, Colorado	Compact concluded. Ratified by both states and Congress of the United States. Operative irrigation season of 1925.
South Platte	Nebraska, Colorado	Compact concluded. Ratified by signatory states. Awaits ratification by Congress.
Colorado	Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming	Compact concluded. Ratified by all states but Arizona New legislation provides for compact effective as among the six states which have ratified, without prejudice to Arizona.
Pecos	New Mexico, Texas	Compact concluded. Awaits ratification by signatory states.
North Platte	Nebraska, Wyoming, Colorado	Hearings held in 1924. Active negotiations under way.
Rio Grande	New Mexico, Texas, Colorado	Engineering studies in progress. Hearings to be held during 1925.
Arkansas	Kansas, Colorado	Negotiations in progress.

Broadly speaking, the compact protects the present development in both states, expansion in both is permitted, all controversy is settled and water titles for future development are determined. The compact may be modified or terminated at any time by mutual consent of the signatory states and upon such termination all rights then established shall continue unimpaired.

The La Plata River Water Compact was framed by Stephen B. Davis, Jr., of Las Vegas, N. M., with Charles A. May, state engineer, acting as consultant, representing New Mexico, and by Delph E. Carpenter of Greeley, Colo., with Ralph I. Meeker of Denver as engineering consultant, representing Colorado.

The accompanying table summarizes briefly the status of Western interstate water compacts which are chiefly concerned with the use of water for irrigation.

Calumet Drainage Ditch Reverses Flow of River

Flood Lands Drained by Ten-Mile Ditch—Overflow Dams and Dry-Weather Bypass—Deep Cut Through Sand Dunes

By Ray D. Hammons
Civil Engineer, Gary, Ind.

TO RECLAIM a tract of about 23½ square miles of good agricultural land in northern Indiana, which at present is practically worthless by reason of long continued flooding every year by the Little Calumet River, a ten-mile ditch is being excavated to reverse the flow of the river so that it will discharge directly into Lake Michigan instead of by a circuitous route to the Calumet River and then northward into the lake at South Chicago, Ill. The general situation is explained by Fig. 1. A considerable portion of the land may be used for truck gardening, as it is near to the cities of Chicago, Gary and Hammond; 2,000 acres are within the city limits of Gary, where 300 acres have been purchased for a public park. The entire area is within a district that is expected to become a great manufacturing center.

The Little Calumet River flows across the northwestern corner of Indiana, in Porter and Lake counties, its course being practically parallel with the shore of Lake Michigan, with its bed about 8 to 13 ft. above lake level, the basin of the river being defined by a line of high sand hills extending along the lake shore. This stream, with a maximum flood flow of 2,256 sec.-ft., overflows every winter and spring, forming a lake about 1x18 miles which remains for several months. The basin of the Little Calumet River, from the point where Salt Creek enters it to the state line, varies in width from ½ mile to nearly two miles. With years of deposits from the Little Calumet River, Salt Creek and Deep River, all arising in clay and soil districts, and with deposits also from decayed marsh grasses, there is now in this valley a rich soil varying in depth from one foot along the edge to 13 or 15 ft. near the river.

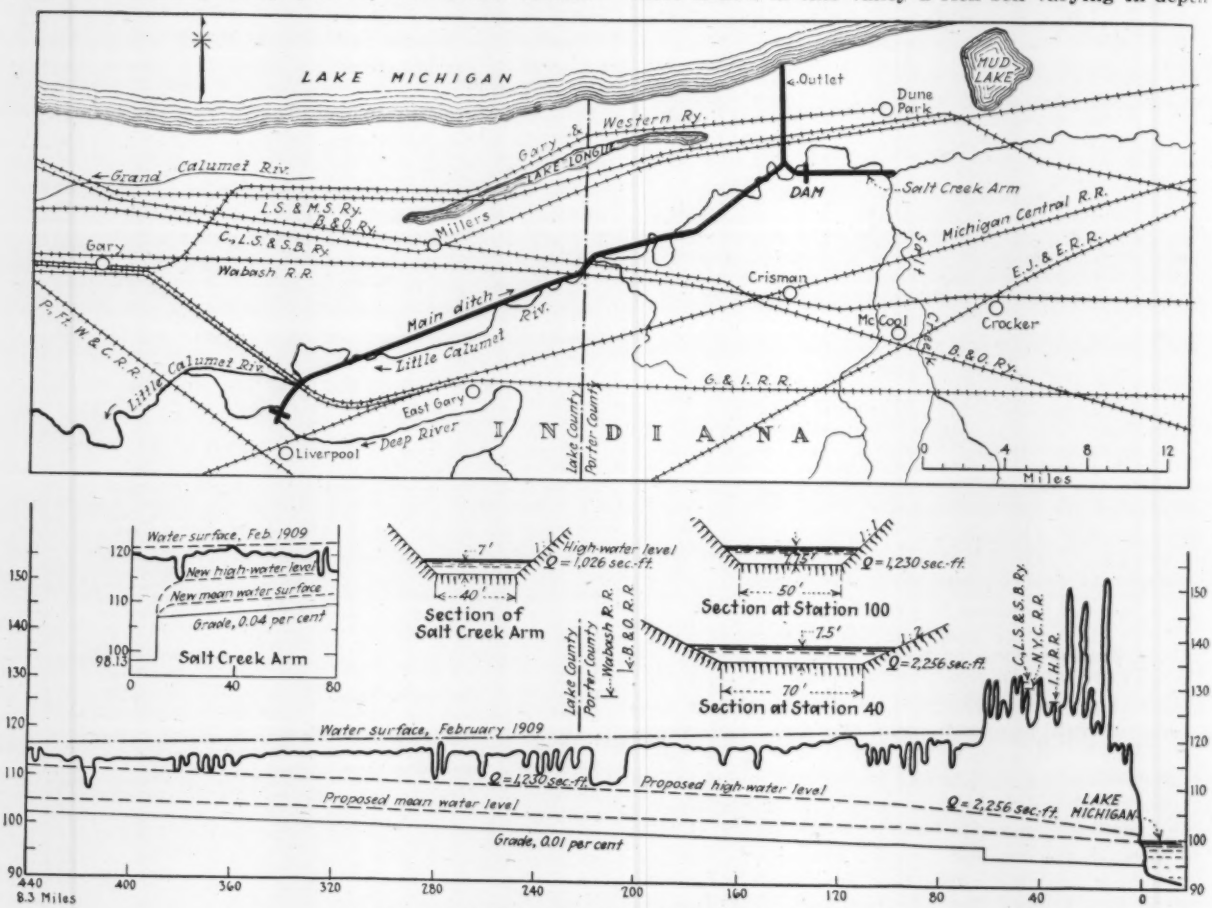


FIG. 1—CALUMET DRAINAGE DITCH IN INDIANA

To relieve the basin of these floods, it is intended to reverse the flow of the Little Calumet River and cut through the large sand dunes to Lake Michigan, about a mile west of the junction of Salt Creek with the Little Calumet. This is the nearest point to the lake, the distance being a little more than a mile. The main ditch starts at Deep River, a short distance from its present junction with the Little Calumet and runs almost in a straight line to the point where it joins the cut across to the lake. The Salt Creek arm starts at the junction of the Little Calumet and Salt Creek and runs direct to where the main ditch cuts through to the lake. These two ditches will take care of practically

all of the flood water. With the water surface of Lake Michigan at El. 100, the elevations of bottom of drainage ditch are 110 at the connection with Salt Creek, 102 at Deep River, 98 at the junction with the outlet ditch and 95.5 at the lake.

Calculations as to the size of channel required to

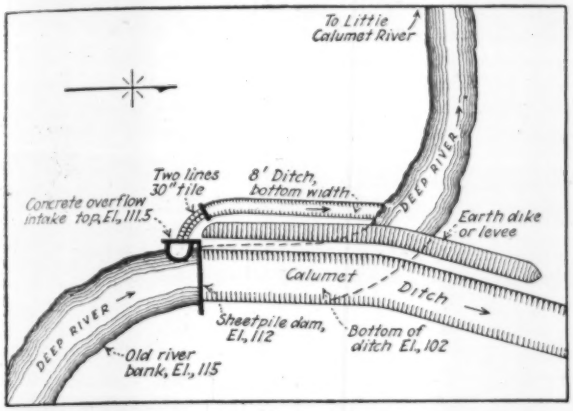


FIG. 2—DIVERSION DAM AND BYPASS

carry the flood waters were made on a basis of the ditches carrying ¼ in. in depth from the entire contributing watershed, which is equivalent to 6.6 sec.-ft per square mile. The total area of the watershed is 333 square miles. From a watershed map the areas that would be drained by the Salt Creek arm and the main ditch were obtained and these multiplied by 6.6, to determine the total quantity of water the two channels would carry. For the channel to the lake, these two quantities were added together. In calculating the necessary sizes for the ditches, Chezy's formula was used to determine the velocity and Kutter's formula to determine the constant for erosion. It was found that for the main ditch, from Deep River to the junction, a ditch 7.2 miles long with a base of 50 ft. and side slopes of 1 on 1 would be necessary. The Salt Creek arm will be 1.5 miles long with a base of 40 ft. and slopes of 1 on 1. From the junction to the lake the outlet ditch will be 1.2 miles long with a base of 70 ft. and side slopes of 1 on 2, owing to the sandy soil. These side slopes are found to stand successfully.

Owing to the drop from the Salt Creek arm into the main ditch, it was deemed advisable to put a dike or submerged dam in the former about 900 ft. from the junction. Having a distance of only 1½ miles for a fall of nearly 11 ft., a straight grade could not be used as it would at flood time have a high velocity and cause too much disturbance at the junction of the three channels. The dike will be of timber pile and crib construction, 9 ft. high, 60 ft. long on the crest. To protect the Lake Michigan mouth of the ditch from silting up by the deposit of sediment or the shifting of the beach sand, two jetties 80 ft. apart will extend 225 ft. from the end of the ditch into deep water. These jetties will consist each of a double row of timber piles with rock filling between them.

This project dates back to 1909 and has been delayed by much litigation. The original survey for the channel, known as the Burns or Calumet ditch, was made by Guy Stinchfield as engineer for the drainage district, and at that time county surveyor of Porter County. Remonstrances against the construction of the ditch were filed by some property owners and by the Lake Shore & Michigan Southern Ry. (now part of the New York Central Lines). Adjustments were made in some of the assessments and the railroad's objection was overruled. The plans called for a new channel to be cut through the right-of-way and as the railroad objected to paying for the required bridge, the company appealed the case to the State Supreme Court and then to the United States Supreme Court. All the decisions were against the railroad company, the courts holding that the district could rightly construct its channel across the right-of-way. The company will, therefore, build and pay for the bridge.

After interruption of the project by the World War, further delay was caused by an injunction obtained by the Public Service Co. of Northern Illinois to restrain the drainage district from diverting the dry-weather flow of the Calumet River. This objection was finally disposed of by an agreement between the company and the district by which the dry-weather flow of Deep River will take its present course westward through the Little Calumet River channel, by the arrangement shown in Fig. 2. The river channel will be blocked by a sheetpile dam forming the head of the new drainage ditch, and a bypass will connect the river channel above and below the dam, an earth levee being built between the two channels, as shown. Above the dam will be an overflow intake, with its top at El. 111.5, to deliver the low-water flow to two 30-in. tile drains discharging into an open ditch leading to the river. When flood water in the upper part of the river rises 6 in. above the top of the intake it will begin to flow over the dam, with crest at El. 112, into the new drainage ditch.

All legal obstacles being disposed of, a construction contract was let in August, 1923. Work was com-

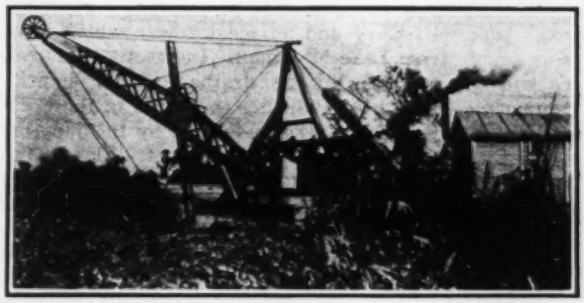


FIG. 3—DREDGE CUTTING DITCH IN SWAMP

menced early in 1924 and is now in active progress. For the 1,657,000 cu.yd. of marsh work the contractor is using a floating dredge equipped with a 2½-yd. bucket. This machine, Fig. 3, works two 12-hour shifts of four men each, except that the day shift has three extra men for supplying coal and clearing right-of-way. Work was begun Sept. 11, 1924, and is averaging 2,000 cu.yd. per day. The cut ranges from 12 to 21 ft. The new channel through the sand hills, consisting of 987,000 cu.yd., was let to a sub-contractor who is using a dragline machine equipped with Diesel engines, for which the fuel oil is hauled by teams in 50-gal. barrels. The bucket is 3½ cu.yd. capacity and the boom is 115 ft. long. This machine, shown in Fig. 4, works three 8-hour shifts of four men each. It began work July 10, 1924, and is averaging 2,500 cu.yd. per day. The cut ranges from 30 to 60 ft., but most of it is about 35 feet.

At the outlet the bottom of the ditch will be 4 ft. below water level.

Five new railroad bridges will be required and the abutments and piers of two others must be rebuilt because of the increased depth of the new channel. There will also be six new highway bridges. The New York Central Lines have started work on their two bridges and contracts for two highway bridges have

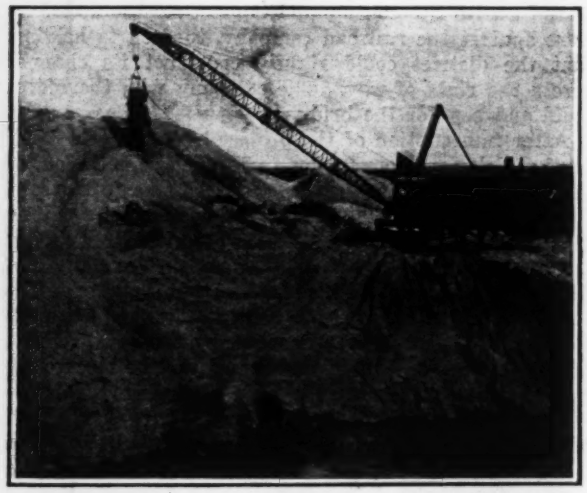


FIG. 4—DRAGLINE EXCAVATOR IN DEEP SAND CUT

been let. These bridges will be plate-girder deck structures with channel spans of 86 ft.

Since the drainage area consists mainly of open country there is little pollution of the Little Calumet River above the point of its diversion to the lake, but should pollution increase owing to industrial development of the district steps would have to be taken to protect the water supply of Gary and adjacent towns which draw their supply from Lake Michigan. Indirectly this project will benefit the Chicago drainage canal and its Calumet-Sag branch by reducing the floods in the Calumet River, which is the stream formed by the junction of the Little Calumet and Grand Calumet. Flood flows in this stream at South Chicago now exceed 10,000 sec.-ft. at times, while the Calumet-Sag channel has a capacity of only 2,000 sec.-ft.

This ditch is being built under the direction of Judge H. H. Loring of the Porter County Circuit Court, for which A. P. Melton, Gary, Ind., is construction commissioner and chief engineer, with the writer as engineer in charge. The general contract was let to the Walb Construction Co., LaGrange, Ind., which company is doing the marsh excavation but has sublet the outlet channel through the sand hills to Broderick Brothers, Detroit, Mich. The contract price is $286,000, but additional court costs and attorney's fees will bring the total cost to about $335,000. Bonds have been issued for $225,000 and $100,000 has been paid in cash. It is expected to have the work completed by December, 1925.

Price of Contractors' Manual Is $5

In "Engineering Literature," in the Feb. 19 issue of *Engineering News-Record*, p. 327, appeared a review of the Manual of the Associated General Contractors of America. 1924 issue. The price of the book was stated as $0.50; it should have been $5.

Features of Design in 1,000-Foot Outdoor Swimming Pool

Independent Retaining Walls, Floor in Sections, and Complete Underdrain System Are Features of San Francisco's New Pool

BECAUSE of the large size of the new outdoor swimming pool recently built by the city of San Francisco, and because the site selected for it seems to be the natural sump or underground collecting point for drainage waters in this part of the peninsula, the design of walls, floor, drainage system and other features were worked out expressly to meet the requirements of this particular location. In other matters, however, such as expansion joints, a strictly waterproof finish, simplicity and convenience of operation, etc., the problems and their solution were such as might attend the design and construction of any outdoor swimming pool. The location is in a 60-acre municipal playground now being developed close to the ocean beach about 3 miles south of the Cliff House. The pool itself is 1,000 ft. long and 100 ft. wide except in the center section opposite the bath house where the width is 150 ft.

At the site selected for the pool the water table is about 4 ft. below the surface of the ground, which

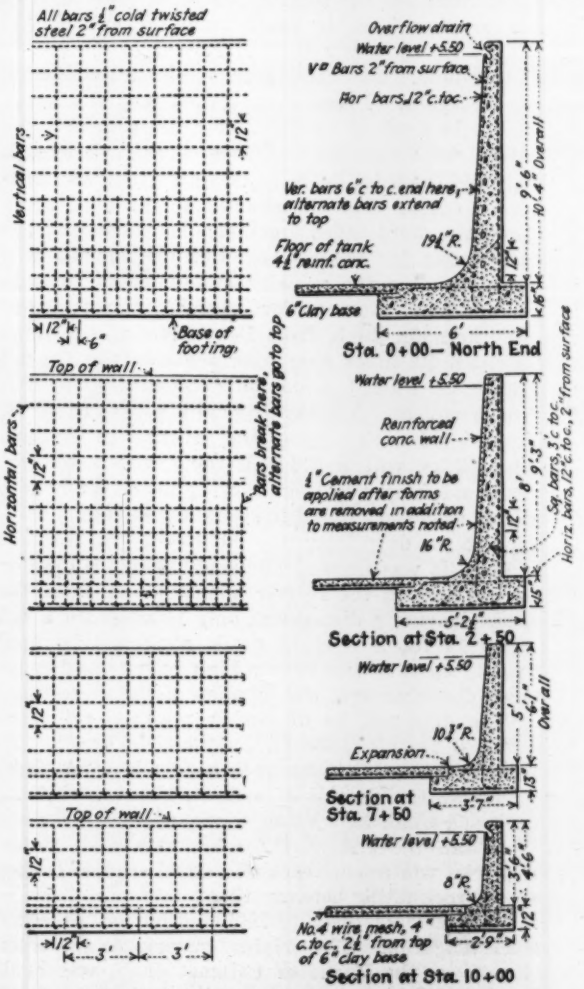

All bars ½" cold twisted steel 2" from surface
Vertical bars
Base of footing
Top of wall
Horizontal bars
Bars break here, alternate bars go to top
Top of wall
Overflow drain
Water level +5.50
V^a Bars 2" from surface
Hor. bars 12" c. to c.
Ver. bars 6" c. to c. end here, alternate bars extend to top
Floor of tank 4½" reinf. conc.
19½" R.
6" Clay base
Sta. 0+00 — North End
Water level +5.50
Reinforced conc. wall
¼" Cement finish to be applied after forms are removed in addition to measurements noted
16" R.
Section at Sta. 2+50
Water level +5.50
10½" R.
Expansion
Section at Sta. 7+50
Water level +5.50
8" R.
No. 4 wire mesh, 4" c. to c., 2½" from top of 6" clay base
Section at Sta. 10+00
Overall
Sq. bars, 3" c. to c.
Horiz. bars, 12" c. to c., 2" from surface

FIG. 1—CROSS-SECTIONS OF TANK WALL
Longitudinal and transverse views at both ends and at two intermediate points.

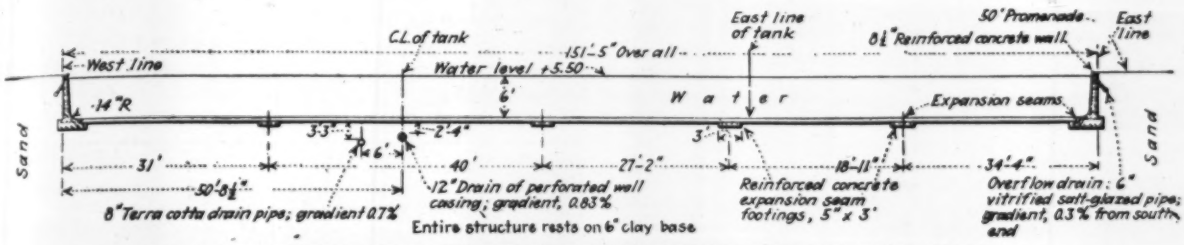


FIG. 2—TRANSVERSE CROSS-SECTION OF SAN FRANCISCO'S NEW SWIMMING TANK

means possibility of a hydrostatic head of 10 ft. on the under side of the floor in the deepest section of the pool, where the water depth is 14 ft. Accordingly, when the site had been unwatered, main and lateral trenches were dug for 8- and 4-in. agricultural tile lines which carry the ground water to a sump just north of the pool. These trenches are all backfilled around the tile with crushed rock so that even in the case of failure of the tile itself the drainage function will probably continue. From the area occupied by the pool there is a delivery to the drainage sump of some 400 g.p.m. In connection with other drainage into the same sump this water is used for supplying the neighboring city parks, golf links, etc.; altogether a total of 1,000 g.p.m. is pumped from this one sump.

With the possibility of hydrostatic pressure on the outside of the completed tank—such as might result from some accident or stoppage in the drainage system—the sides of the tank were designed as self-supporting retaining walls, able to resist independently either external or internal thrust. Expansion joints were put in at frequent intervals along the walls so that in the event of the failure of one section from any cause the damage would be localized and need not extend beyond the nearest joint.

The floor of the tank likewise was laid in sections, the sizes ranging up to a maximum of 40x47 ft., expansion joints of plastic asphaltic compound being used between adjoining slabs. The concrete floor slab was poured on a crushed rock and rolled clay base (beneath which are the drains already mentioned) and around the edges rests on a 9-in. shoulder of the retaining wall base formed expressly for this purpose.

The floor slabs are 4½ in. thick plus a ½-in. cement plaster finish on top. This same plaster finish, which is put on the interior of the side walls, is made waterproof by integrally adding 5 per cent waterproofing compound. The walls are reinforced with deformed steel bars, and the floor with 4x4-in. electrically-welded fabric, placed in the center of the slab. In the walls all steel is kept 2 in. from the surface. The concrete mix in both floor and walls is 1:2:4.

Under all joints in the floor are concrete strips or slabs 3 ft. wide, reinforced with steel bars and having the same thickness and plaster finish on top as the floor itself. These slabs were intended to insure mobility of the floor section, thus preventing distortion that might occur as the result of buckling. They were coated with asphalt paint before the floor slabs were poured. In

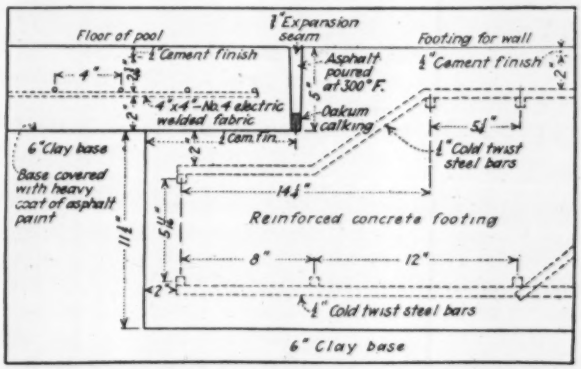


FIG. 3—EXPANSION SEAM DETAIL AT FOOTING

waterproofing the floor joints the first process was to wedge tightly into the bottom of the cracks between adjoining slabs a 1-in. layer of oakum calking, and on this the elastic waterproofing compound was poured.

The expansion joints in the side walls are provided with water stops consisting of copper sheets which pass from one side to the other of the adjoining wall surfaces so that mastic can be poured on opposite sides of the copper, thus insuring a tight joint against either escaping or infiltering water.

Since this pool is supplied with salt water from the Pacific Ocean which is only a few hundred feet distant

FIG. 4—SAN FRANCISCO'S NEW 1,000-FT. OUTDOOR SWIMMING POOL

and since the water level in the pool is only 12 ft. above mean low tide, the pumping and piping systems for the tank are quite simple. A single 16-in. main terminating on the floor of the tank can be used either as drainage or supply line. The pump is located in this line in a bypass around the main sea-valve, the latter being opened only when it is desired to drain the tank. Drainage of the tank can be effected at any stage of the tide at the rate of about 7,000 g.p.m. and sea water can be pumped into the tank at almost the same rate. When desired a circulation can be maintained by pumping into the tank through the 16-in. line and allowing the surplus to flow off through the scum rail collector which delivers into an overflow line extending entirely around the tank.

Earl Clements, engineer for the San Francisco Park Commission, designed the tank and supervised its construction.

Double-Deck Footbridge Connects Chicago Office Buildings

A THIRD-STORY bridge connecting two sections of a large office building is a novel development included in the structural design of the Wrigley Building, Chicago. This 20-story skyscraper structure covers two city blocks, both fronting on the upper level of the double-deck portion of Michigan Ave., but separated by North Water St. which is on the lower level. Since this property is operated as a single unit, in charge of one manager, its two basements are connected by a tunnel and it was considered advisable to provide a covered upper-story bridge or gallery for the convenience of tenants. The completed structure is shown in Fig. 1.

This bridge, which is a through plate-girder structure at the third floor above Michigan Ave. and is placed a little distance back from the face of the building, is carried by independent columns and is also

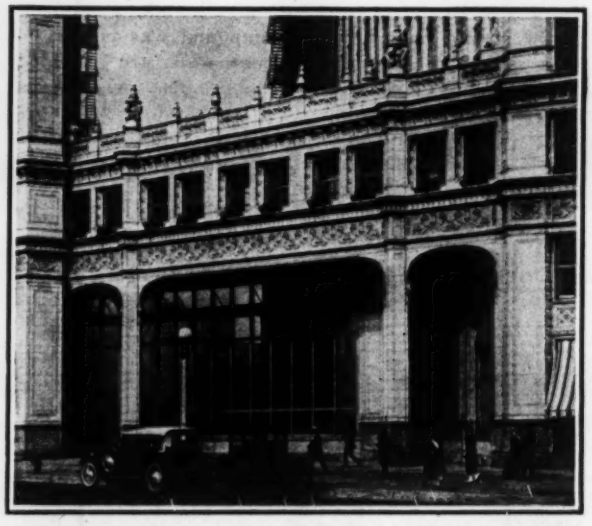


FIG. 1—THIRD-STORY BRIDGE WITH SIDEWALK WINDSHIELD; WRIGLEY BUILDING, CHICAGO

braced to the framing of the building, which is suitably reinforced for this unusual loading. On the girders is a steel frame for the sides and roof of the gallery. Large glass windows are provided above the girder and the structure is cased in white glazed terra cotta designed to harmonize with the architectural treatment of the building.

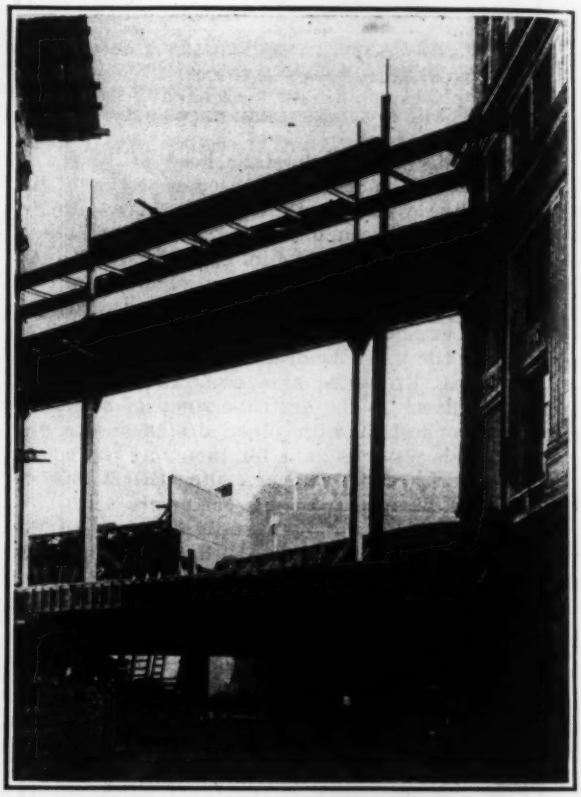


FIG. 2—ERECTION OF WRIGLEY BUILDING BRIDGE

The large girders, with roof framing attached, are at the third floor above the upper deck of Michigan Ave., on the viaduct. The street below is North Water St., separating the two sections of the building and crossing the lower level of Michigan Ave. The hangers carry steel framing for a widening of the viaduct sidewalk.

An auxiliary feature of the structure is that hangers attached to the girders support steel framing for a widening of the Michigan Ave. sidewalk, as shown by Fig. 2. This space forms a colonnade and has a glass wind screen extending from the sidewalk to the bridge, closing the space between the buildings. Since this is a point at which people wait to take taxicabs and buses, it was considered by the owner of the building that such a protection would be a public convenience and would improve the appearance of the bridge and structure generally (see Fig. 1).

Unless the glass is kept clean, the wind screen would soon become unsightly and for this purpose a runway and track for a cleaner's ladder is provided on the rear side. Other methods of effecting this purpose were considered, including pivoted sash, but the arrangement of fixed sash and a traveling ladder was decided upon as must satisfactory. The screen is designed for a wind pressure of 25 lb. per square foot.

This building, with its bridge and wind screen, was designed by Graham, Anderson, Probst & White, architects, and was built by Lanquist & Illsley, general contractors.

Waterless Gasholders Built at Michigan City and Flushing

Holder of New Type Introduced From Europe—Has Fixed Bell and Moving Piston Made Tight by Tar-Filled Flexible Seal

A RADICALLY new type of gasholder, the waterless gasholder, which is being introduced into American practice by the Bartlett-Hayward Co., gasholder builders, of Baltimore, was described recently in a paper read by Alten S. Miller, vice-president of the company, before the Western Society of Engineers. Two of the holders have just been completed, at Michigan City, Ind. (1,000,000 cu.ft.) and at Flushing, N.Y. (3,000,000 cu.ft.). In the waterless holder the bell is fixed, and the gas is confined and placed under pressure by a piston within the holder, moving up and down as the gas volume increases and decreases. The piston is a huge assemblage of trusses and shell plating occupying the entire cross-section of the holder and sealed against the side walls of the holder by a flexible sliding plate submerged in tar. This construction eliminates the water-filled tank and cups of the ordinary type of holder, as well as the entire guide frame. The foundation load is therefore greatly decreased; the foundation load of a 6,000,000-cu.ft. holder is given as 45,000 tons for the ordinary type and 3,000 tons for the waterless type.

Typical drawings of the waterless gasholder construction, taken from Mr. Miller's paper, and a photograph of the Michigan City holder, are shown in Figs. 1 and 2 herewith. A holder of 15,000,000 cu.ft. capacity to be built at Harrison, N. J., will be of substantially the same construction. About 50 waterless holders are in operation in Europe, where the type originated about fifteen years ago.

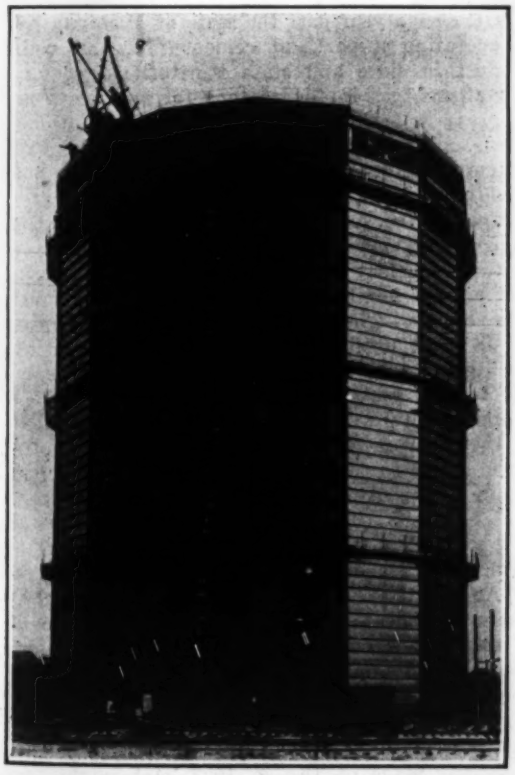


FIG. 1—MICHIGAN CITY HOLDER, CAPACITY 1,000,000 CU. FT.

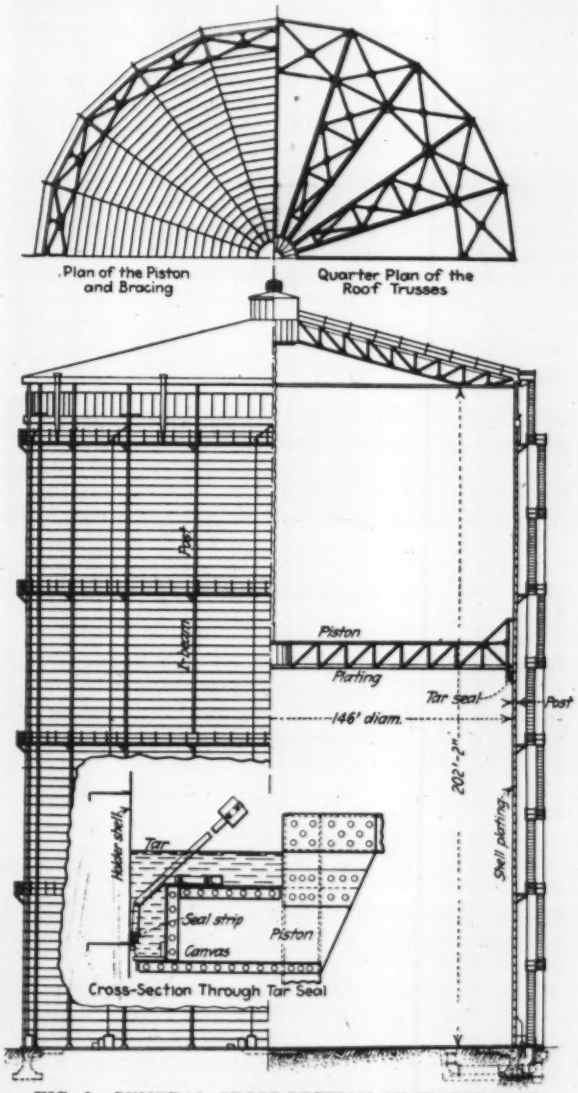


FIG. 2—GENERAL CROSS-SECTION OF WATERLESS GASHOLDER AND SEAL

As described by Mr. Miller, the outline of the holder shell is a polygon having from 10 to 28 sides, consisting of straight shell plates with stiffened horizontal edges, attached to supporting columns placed at the corners of the polygon. The roof plating is carried by radial trusses connected to the columns. Inside the holder is the piston (shown as a truss in Fig. 2), which is guided by a number of radial rollers bearing against the shell at the columns and by several pairs of brass tangential sliding guides. The piston is sealed to the wall in the manner shown by a separate detail in Fig. 2. A slightly dished sliding plate bearing against the holder wall and pressed outward against it by weighted levers is connected to the side of the piston by canvas. The plate and canvas are placed near the bottom of the outer edge of the piston, so that an annular trough is

formed above them, which is filled with tar. This tar forms the actual gas seal, while the sliding plate serves to retain the tar. Any tar that leaks past the sliding plate is caught at the bottom of the holder in an annular reservoir, from where it is pumped to supply tanks at the top of the holder and can flow down to replenish the seal. The pumping is done by automatically controlled gear pumps specially designed for handling this heavy liquid; the pumps operate only a few minutes per day in the aggregate.

The columns of the holder are of I-beam section. The shell plates, which are straight, are stiffened by flanging. As indicated in Fig. 2, the upper edge of each plate is flanged out in channel form (radial depth 7 in. at Michigan City, 9 in. and 8 in. at Flushing), while the lower edge is flanged to a simple right-angle bend 2½ in. wide, which fits against the back of the channel-shaped upper edge of the plate below and serves for riveting the two plates together. A strip of red-leaded canvas is laid in the joint before riveting. The plating of the bottom is calked. In the Michigan City holder, which is 105 ft. in diameter and 136 ft. 8 in. high from top of foundation to eaves, the side plating is No. 9 steel. The Flushing holder, Fig. 4, 146 ft. in diameter by 202 ft. high, has ⅜-in. plating.

Near the top of the holder vent pipes are provided in the sides and extend up above the roof, allowing gas to escape when the piston rises high enough to uncover them; this prevents the piston being raised high enough to strike the roof.

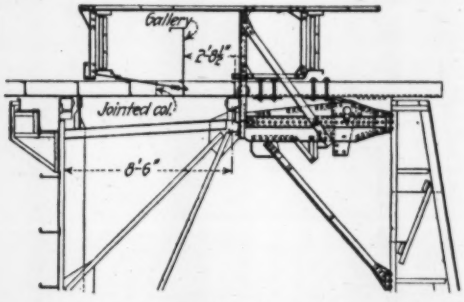


FIG. 3—ERECTION STAGING TRAVELS UP WITH PISTON

As the space above the piston is free of gas, the piston and the holder are open for inspection while the holder is in use. To facilitate such inspection, windows are provided in the sidewalls just under the eaves, to light the interior, and a ladder is hung from the roof in the center line of the holder, folding on the piston as it rises and unfolding as the piston falls. Similarly, there are several inspection balconies around the outside of the holder, reached by stairway from ground.

Erection—This type of holder is erected by a method as unusual as the design of the structure. The piston is built inside the lower section of the shell plating as soon as the latter has been placed, and the roof is built on supports resting on the piston; an erection stage is attached to the outside of the piston, and from this stage additional lifts of columns and sideplating are set up. As each line of side sheets is put in place, the piston is raised by pumping air under it, and when it has reached the proper level for continuing work it is hung by hooks to plates which are fastened to the columns. Thus the holder is built up and finally the roof connected in its permanent position. Derricks placed on the roof handle the material during construction, and thus the entire erection plant moves up together. No tar is used in the seal during the construction period. The scaffold and fastening arrangement used in erecting a 500,000-cu.ft. holder are shown in Fig. 3.

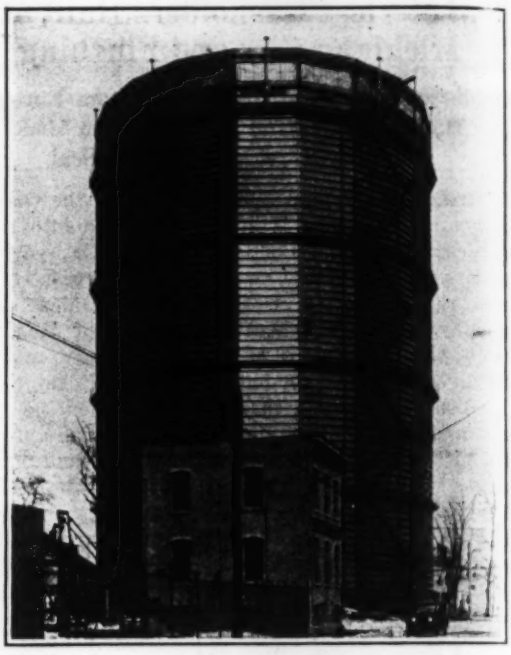


FIG. 4—3,000,000-CU.FT. GASHOLDER AT FLUSHING

Michigan Operates a Portland Cement Mill

FOR over a year past the state of Michigan has been operating a portland cement mill and using the product in state and state institutional construction. A statement as to the reasons for this move and the progress in the administration of the plant has been furnished *Engineering News-Record* by Henry Croll, Jr., budget director of the State Administrative Board of Michigan. Mr. Croll's statement is as follows:

"During the year 1922, the Michigan State Highway Department experienced a great deal of annoyance in getting sufficient cement for its requirements, and in fact a large number of projects were not completed on this account. The cement situation was somewhat better in 1923 until the Huron Cement Co., at Alpena, Michigan, had a fire which stopped all shipments from our largest source of supply for a number of weeks. While the different cement companies were doing all in their power to assist in this emergency, still they were unable to furnish the extra cement that had been coming from Alpena. Governor Groesbeck conceived the idea that with our large requirements we should own or control the entire output of some mill and he advocated that Michigan should build a cement mill.

"At this time the Michigan Portland Cement Co., of Chelsea, advised us that they were about to dispose of their plant and we immediately made a survey of the mill and finally leased it for a term of five years at a rental of $75,000 per year, with an option to purchase at any time before three years at $500,000 without interest, all rent to apply on purchase price. This lease was made on Dec. 1, 1923, and on this date we took the plant over as a prison industry and have operated it as such since that time.

"We retained the same superintendent and foremen and replaced the other labor with prisoners and this plant is in reality a branch of the Jackson State Prison. We have adopted the same cost accounting as is generally used by commercial cement companies. Our road and bridge requirements for the past year were 1,800,000 bbl. of which we furnished 400,000 and in addition we shipped approximately 75,000 bbl. to our several state institutions. We did not sell any cement to commercial customers. Our capacity for 1925 will be 700,000 bbl. and we will be able to use it all in our highway and institutional work."

Study of Impact in Its Relation to Pavement Design

Resistance to Impact Is Affected by Thickness of Concrete Slab, Coarseness of Aggregate and Cement Concrete

By G. W. Hutchinson

Eastern Manager, Concrete Department, Celite Products Co., New York

At the time these tests were carried out the author was assistant engineer of the North Carolina State Highway Commission in special charge of research and testing.—Editor.

Concrete used in road work seldom fails from direct compression. Direct impact is approached in the finished pavement when the latter is required to withstand the pounding of heavy traffic over its surface. That a given static load is multiplied several times when transferred into an impact stress has been clearly shown in work carried on by the Bureau of Public Roads. One seems justified then in giving the slab thickness consideration when these factors are considered.

In the impact tests given here the specimens were concrete slabs 20 in. in diameter. The test consisted of dropping a 10-lb. hammer from a constant height of 2 ft. to a steel ball, 3 in. in diameter, which rested on the middle of the upper surface of the slab. The slab rested on a three-point bearing, each point being covered with a pad of rubber. Rebound was limited by the use of rubber padded clamps on top of the specimen, two to each bottom bearing, making three sets of three-point bearings vertically.

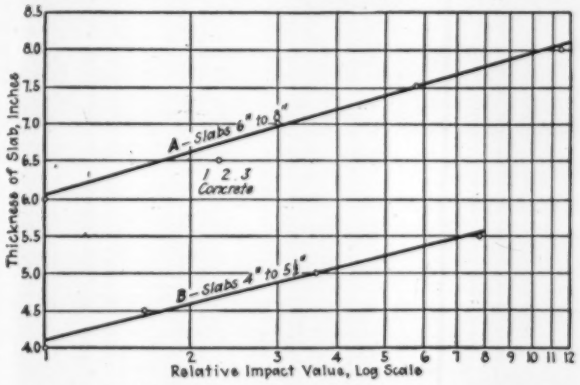
The slabs ranged from 4 to 8 in. in thickness. They were tested at the age of three months and each result is the average of ten individual specimens. The proportions of mixture were 1:2:3, using coarse aggregate from ¾ to 1½ in. The test results given are typical of the effect of slab thickness on the resistance to impact when tested by this method. The average results are given in the table. Variation in relative values would be secured with changes in the gradation, type and size of the aggregate and the amount of cement, etc.

RESULTS OF IMPACT TESTS SHOWING INFLUENCE OF SLAB THICKNESS

Thickness of Slab In.	No. Blows for Failure	Relative Value
4.0	5	0.3
4.5	8	0.5
5.0	18	0.10
5.5	39	0.21
6.0	183	1.00
6.5	415	2.27
7.0	551	3.00
7.5	1055	5.80
8.0	2060	11.30

The relation between the different slab thicknesses is plotted on a logarithmic scale in the chart. The relation is plotted with reference to the slabs from 4 in. to 5½ in. thick, and from 6 to 8 in. thick. The two curves are not exactly parallel but a general direct relation is obtained.

With such knowledge of the effect of impact on the various concrete mixtures, gradations and types of aggregates and slab thicknesses, derived from laboratory work, it is possible to explain to a reasonable degree the seeming defects appearing in certain pavements when compared with others constructed in accordance with the same practical standards or specifications.



EFFECT OF IMPACT ON CONCRETE SLABS

Inasmuch as each of the elements mentioned appears to have a decided effect on the resistance to impact of the pavement, it is possible to secure an economic design by adjusting one requirement in the specifications to compensate for another which cannot be economically changed. While no data are available on the effect of reinforcement on the resistance to impact of the slabs, it is questionable if its advantages are brought out by the use of the larger sizes of coarse aggregate.

With reference to the total work carried on, which includes impact and compression tests of different types and sizes of coarse aggregates, and different cement contents, the following statements appear justified in connection with pavement design:

1. With all other factors equal, the concrete increases in resistance to impact as the cement content is increased. The increase in cement content is more effective with the smaller sizes of coarse aggregate than with the larger.

2. With all other factors equal, the concrete increases in resistance to impact as the size of the coarse aggregate is decreased.

3. The present standard tests for coarse aggregates are not indicative of the resistance to impact of the concrete containing them. Neither is this true in compression.

4. In normal mixtures, containing a well-graded aggregate, the resistance to impact is proportional to the compressive strength of the concrete when tested at the later ages.

5. Reduction in maximum size of weaker coarse aggregates will offset certain differences in the quality of the concrete when compared with stronger types of coarse aggregate having greater maximum size.

6. The impact test of concrete is suitable for use in

determining the economic size and type of coarse aggregate.

The size of the coarse aggregate should be considered in connection with the slab thickness. When this has been determined, the cement content should be regulated to obtain the desired compressive strength in the concrete using the selected size and type of coarse aggregate. At that time, any improvement affecting the resistance to impact of concrete will have a similar effect on compressive strength.

7. The test results indicate that slab thickness should be given first consideration, with the size of coarse aggregate, amount of cement, and the type of coarse aggregate following more or less indefinite order, depending entirely upon the quality of the available materials.

8. Regardless of the selection of aggregates or mixture, the uniformity of the concrete in place is of extreme economic importance and is of nearly as much practical benefit as the thickness of the slab itself.

Flood Damages Power Plant in the Rio Cobre Valley, Jamaica

Rainfall of 12.77 In. Causes High Water in Narrow Valley—Pipe Line Undermined and Partly Swept Away

By F. L. Bronstroph
Assistant Engineer, Kingston & St. Andrews Corp., Jamaica, B. W. I.

A FLOOD of unusual proportions, sweeping down the valley of the Rio Cobre near Kingston, Jamaica, British West Indies, undermined and swept away part of the pipe line of the hydro-electric plant of the Jamaica Public Service Co. and partly submerged the

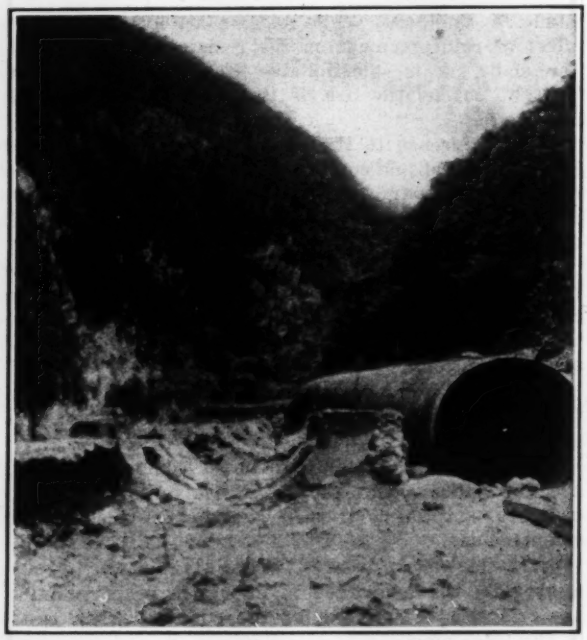


FIG. 1—PIPE LINE ABOVE BREAK LIFTED BODILY FROM ITS SUPPORTS

generators in the power house. The power plant was built 26 years ago by Hugh L. Cooper, of New York. During its life it has gone through one other serious

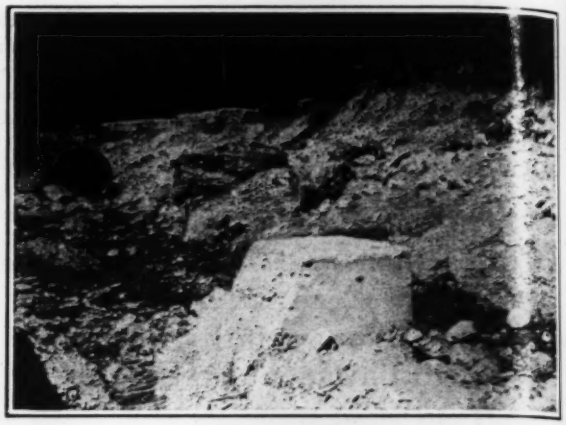


FIG. 2—HIGHWAY, PIPE LINE, AND TRANSMISSION LINE CARRIED AWAY BY EROSION

flood without damage to the pipe line and with no damage to the power house other than from partial submergence. It is situated in the narrow valley of the river about 21 miles from Kingston. Water is taken from the river at a weir 17 ft. high and 120 ft. long across the stream 6,250 ft. above the power house, and carried to the power house in an 8-ft. diameter pipe line laid along the left bank of the river. The head at the power house is 55 ft. The pipe line is supported throughout its length on concrete saddles which are carried to rock. The pipe is made up of ¼-in. steel plates in sections 6 ft. long riveted with ½-in. rivets at 2-in. centers. There are three expansion joints made of 4-in. lap joints calked with lead wool, in the length of the pipe.

During the flood a 600-ft. section of the pipe line, at a point midway between the weir and the power house, where the pipe line is on the inside of a sharp bend in the river, was carried away and a portion of the pipe line above this point was lifted bodily out of the saddles and displaced to one side. The greater portion of the section of pipe which was carried away was swept downstream about 3,000 ft. and stranded upon an island in midstream.

The depth of water in the narrow valley was so great that the power house, which has its floor 20 ft. above the normal river level, was flooded to a depth of 6 ft. 3 in. over the floor.

The flashboards on the diversion weir were carried away, also some of the concrete piers supporting them.

The area drained by the river and its tributaries comprises some 120 sq.mi. of country above the diversion weir and consists for the most part of a great vale surrounded by high hills and having the appearance of the basin of a prehistoric lake. The geological formation consists of a chalky calcareous rock, which on decomposition produces a clay soil. The only exit for water collecting in this area is through the narrow rocky Rio Cobre gorge, which in some places, such as at the diversion weir, is only 150 ft. wide. The graph shown in Fig. 3 gives the values for the average monthly rainfall over the drainage area for 1924 up to November, and the average monthly rainfall for the past fifty years. It is interesting to note that while the fifty-year curve gives two peaks, one in May and one in October, the three maximum floods on record all occurred in the month of November.

Estimates of the flood flow during the 1924 flood made from measurements taken at the 287-ft. irrigation weir 4 miles below the power station, where the water height was 12 ft. 9 in. over the crest, give a maximum discharge of 54,000 sec.-ft. The average discharge of the river is 180 sec.-ft.

The flood history of the river is an interesting one. The greatest flood occurred in November, 1870, and destroyed the first irrigation weir at the site of the present one. There are no rainfall records available and the flood discharge was estimated at 75,000 sec.-ft., which is probably high, there being no means of gaging it. Flood waters of the river stood 2 ft. higher than the flood of 1924.

Another flood in November, 1909, occurred in a month when the average rainfall was 21.66 in. and the maximum intensity in 24 hr. was 9.13 in. The elevation of water at the irrigation weir was the same as in the 1924 flood. The power house was partly submerged during that flood, but little damage was done to the pipe line.

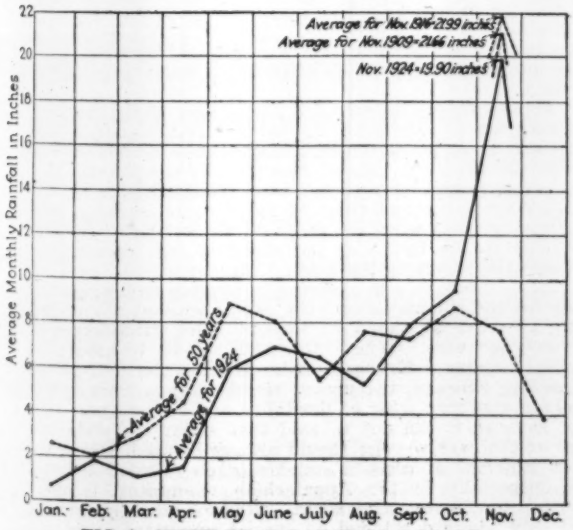


FIG. 3—FIFTY-YEAR RAINFALL RECORD

A smaller flood occurred in November, 1916, in a month when the average rainfall was 21.99 in. and the maximum intensity for 24 hr. was only 5.5 in. The maximum river discharge at that time was 17,000 sec.-ft. As opposed to these records, the maximum intensity for 1924 was 10.64 in.

Repair Work—Within an hour after the subsidence of the flood, salvage work was started in the power house. The silt carried into it by the river was cleaned out and open fires were started on the floor preparatory to baking out the water from the generator winding. Sheet-iron ovens were erected and the baking-out process continued until satisfactory results were obtained about three or four days later.

FIG. 4—CUTTING APART THE STRANDED SECTION OF THE PIPE LINE

The process of salvaging the pipe consisted of punching out the rivets from sound plates, passing the plates through a rolling machine and re-riveting them. Two plates bent to the correct curve make a complete 6-ft. section of the pipe. The plant was out of commission about three months. The total damage was estimated at $25,000.

[*Comment upon this plant by Hugh L. Cooper appears in the correspondence columns on p. 451 of this issue.*—EDITOR.]

Long Line of Precise Levels Completed

The Geodetic Survey of Canada recently completed a line of precise levels 1,252 miles in length, extending across northern Ontario and Quebec, which constitutes a new record for such leveling in that the entire line was run by the same person, G. E. B. Sinclair, a geodetic engineer on the staff of the survey. Starting in the spring of 1920 at the intersection of the Canadian Pacific and the Canadian National Ry.'s main line, some 70 miles east of Winnipeg, the levels followed the Canadian National's transcontinental line across Ontario and part of Quebec to Hervey Junction in the St. Lawrence Valley, between Montreal and Quebec, and thence down along the Canadian National and Canadian Pacific tracks to the St. Lawrence River at Three Rivers, Que., where it tied in to a benchmark established some years ago. In each of the five field seasons the working period was only four months.

Compare Standard and Narrow Gage for Logging Railroads

With Similar Construction Except Width of Track Standard-Gage Costs Little More and Has Many Advantages

IN LOGGING railroad practice there is considerable controversy as to the respective merits of standard-gage and narrow-gage lines, but that the former have economic and operating advantages was claimed in a paper read at the annual meeting of the Appalachian Logging Congress by M. W. Stark, American Column & Lumber Co., Columbus, Ohio. An abstract of this paper is given below:

It is not possible to lay down a universal rule but it is possible to determine whether narrow-gage or standard-gage is better under given conditions. Since the term "standard-gage" is sometimes taken to imply a logging road with heavy grading, bridging and equipment, I define a standard-gage logging railroad as different from the narrow-gage road only in that the rails are 4 ft. 8½ in. apart instead of 36 or 42 in. apart. For doing the same amount of work, there is no occasion for more elaborate construction work nor for heavier equipment on the standard-gage than on the narrow-gage railroad, unless it is desired to do something more than transport logs to a sawmill. The point to be considered is, what type of road will do the required work best and cheapest; the chief factors in this are the costs of construction, of maintenance and of operating.

Grading—Unless a considerable part of the work is on hillsides, the grading for standard-gage can be done as cheaply as for narrow-gage, because the cheapest grading can be done by a steam shovel and the width of the shovel requires a subgrade as wide as that for standard-gage track. The bridges need be no more expensive, for if heavy equipment is not contemplated the only difference is the slightly greater width.

But if unusual physical difficulties are presented, of which steep hillsides are the most important, a narrow-gage road may be far cheaper, especially where there is much rock or where there is danger of slips. For a standard-gage railroad on a steep mountain side, the yardage which must be moved is frequently twice as much as for a narrow-gage, because the extra earth must be moved from the up-hill side of the cut. Where switchbacks are necessary, the amount of side-hill work is increased.

Track—Larger ties needed for standard-gage form an item of increased expense, which must be measured largely by the availability of local tie timber. However, the larger ties last longer and on the branch lines they can be re-laid oftener because they will stand more spiking than narrow-gage ties and there is less loss through decay and breakage. It is sometimes considered that a standard-gage road needs less ties to the mile because of their heavier weight and the greater stability of the track.

There is some increased expense in ballasting, but this is not always in direct proportion to the increased width, and the actual extra cost must be measured by the availability of ballast and by the character of the ground. On the branch lines, the difference between narrow and standard-gage in this respect is usually very small, since the road is of a temporary nature and has little if any ballast. As the larger ties provide a wider bearing they make the ballasting and surfacing less expensive, offsetting in a large degree any extra amount of ballast due to increased width of road-bed. It is often possible to use temporary standard-gage branch lines without any ballast, where ballast would be needed under narrow-gage track.

There is usually no difference in the matter of rail, because the same weight of equipment is contemplated, while most of the rail now used is leased from railroads and the smallest rail obtainable is heavy enough for all purposes. In bolts, angle bars and switches, the conditions are practically the same for either gage. The cost of laying the track differs only in the size of the ties and is practically the same with either gage.

Maintenance Cost—There is less replacing of ties on a standard-gage road because of the longer life of the larger ties; there is usually slightly more cost for the ties, but this depends upon the availability of tie timber. Further, for standard-gage, the culls from the ties at the mill can be used at considerable saving. Surfacing track is less expensive because of the larger ties and better bearing on the ground, and because on a standard-gage railroad a larger variation in the track level may be permitted, the center of gravity of the load being farther from the rail than on narrow-gage track. Since the bridges and the weight of the equipment are practically the same, there is no difference in bridge repairs, except that keeping the track level is of less importance on the standard-gage. As to maintenance standards, a standard-gage road can be operated and maintained with a somewhat lower standard of maintenance than a narrow-gage road, with the same safety and efficiency.

Operating Cost—This is considered as the cost of transporting logs to the mill, and the maintenance and depreciation of equipment. Less logging cars are needed on a standard-gage railroad by reason of the greater capacity to the cars. We put about 2,000 ft. on a narrow-gage car and 3,500 ft. on a standard-gage car, so that the mill can be supplied with half the number of cars, which means half as many cars to keep in repair. The standard-gage cars being heavier will stand rough usage much better than the lighter narrow-gage cars. In most instances more logs can be hauled with one engine because of the shorter length of the train and the decreased train resistance. In steep hollows where it is possible to haul only a limited number of cars, more logs can be taken out at one trip than with narrow-gage equipment. This is important where there is not room for sidings and the engines must make long trips to switch cars in and out.

In many cases it is possible to use fewer engines on a standard-gage road because of the greater footage it is possible to haul in one trip, the advantages mentioned in handling cars at the heads of steep hollows and the fewer carloads necessary to supply logs to the mill, also the shorter time required to load a given number of logs. Furthermore, on standard-gage lines there are likely to be fewer derailments, due to greater stability of track. Derailments can be prevented on narrow-gage, of course, by a higher standard of maintenance, but this increases the maintenance expense.

Grades and Curves—Much has been said about steep grades and sharp curves as barriers to the use of standard-gage roads. There is no difference in favor of the narrow-gage in the matter of the steepness of the grades that an engine of any given size can negotiate. In some cases, due to the lesser number of cars required, more footage can be hauled on the standard-gage than on the narrow-gage with the same weight of engine. It is true that a standard-gage engine will not take as sharp curves as the narrow-gage engine, but it will take the sharpest curves found on the vast majority of lumber operations. If it is necessary to have sharper curves than can be negotiated by a standard-gage engine, there is no question as to which gage should be used.

A standard-gage railroad has advantages in the fact that the majority of operators are using standard-gage equipment and there is, therefore, a more ready market for the equipment when the logging operation is completed. It is also easier to pick up a second-hand standard-gage locomotive. When large quantities of by-products, such as bark, acid wood or pulp wood are produced, the saving in handling cost, due to the fact that the standard-gage cars can be run into the woods to the loading place, is of no small importance. There is also a saving in hauling hay, grain and other carload shipments into the camps without rehandling. Rails also can be taken in without being transferred to narrow-gage cars. Where the mill has to transport its lumber shipments for some distance from the mill to the connecting railroad, the use of standard-gage lines in the woods is another factor of flexibility and convenience.

In general, it can not be said that either the standard-gage or the narrow-gage should always be used, but in the great majority of cases a standard-gage railroad for logging, especially in the Appalachian mountains, is more efficient and more economical. Narrow-gage should be used only where demanded by special conditions and these apply almost entirely to the cost of grading.

Activated-Sludge Experiments on Packing House Wastes

Studies of Surface and Diffused Air Aeration Lead to Design of Latter Type of Plant for Houston Packing Co—Company Treatment Plant Preferred to Treatment by City

By G. L. Fugate
Assistant City Engineer, Houston, Texas

As a result of somewhat extended experimental studies of the character and treatment of packing house wastes at Houston, Texas, it has been decided that a separate activated-sludge plant is to be preferred to sending the wastes to be treated by the same process at one of the two city activated-sludge plants. The preparation of construction plans was authorized by the Houston Packing Co. late in January of this year.

During the summer of 1922 a series of investigations was made to determine the character of waste and the volume of flow from the packing house, primarily to decide definitely whether or not this waste could be economically treated by the city sewage-works. This survey disclosed two routes by which the waste reached the waters of the upper Ship Channel, one for the waste from the slaughter and dressing rooms, and the other for the waste from the engine room, paunch cleaning tanks and stock pens. The first is noted in Fig. 1 as the "flow through grease trap," the other as "gully flow."

Only cattle and hogs are killed at this plant. During the period of the investigation the number of cattle exceeded that of hogs, but for the future it is expected that the hogs will lead in number, although seasonal variations may reverse the ratio. The character of wastes as determined in 1922 is shown by Table I.

After giving due consideration to the character of the packing house wastes and the design and operating features of the city plants, the conclusion was reached that although the activated-sludge process was the only one offering potential prospects of satisfactory treatment, this could be applied economically only at the point of origin.

Upon being advised of these conclusions, by the city engineer, the company took steps to have a plant constructed that would relieve the Ship Channel of pollution, as requested by the federal and city authorities. Designs were made for an activated-sludge plant, but the power requirements were considered excessive, and the work was held up.

At the request of the company, the writer began a study of the economics of aerating the waste, so that a satisfactory plant might be designed, constructed and operated within reasonable cost, and to that end an experimental plant was put into operation in July, 1924, and operated for three months.

The plant was connected to the sewer line originating in the slaughter and dressing rooms; the waste passed through a small tank functioning as a grease collector. The average strength for the entire period is represented by 1,793 p.p.m. of suspended solids and a 5-day biochemical oxygen demand of 1,235. The daily concentration varied widely from the averages just given. The concentration also varied widely in the series of experiments, and for this reason the concentration for each series is considered as a percentage of the average for the entire time.

Surface Aeration—The experiments seemed to offer an excellent opportunity to compare surface aeration by mechanical apparatus along with aeration effected by diffused air. A small "simplex" aerator was put in operation July 1. This apparatus consists of vanes which revolve at the surface of the liquid, working in a

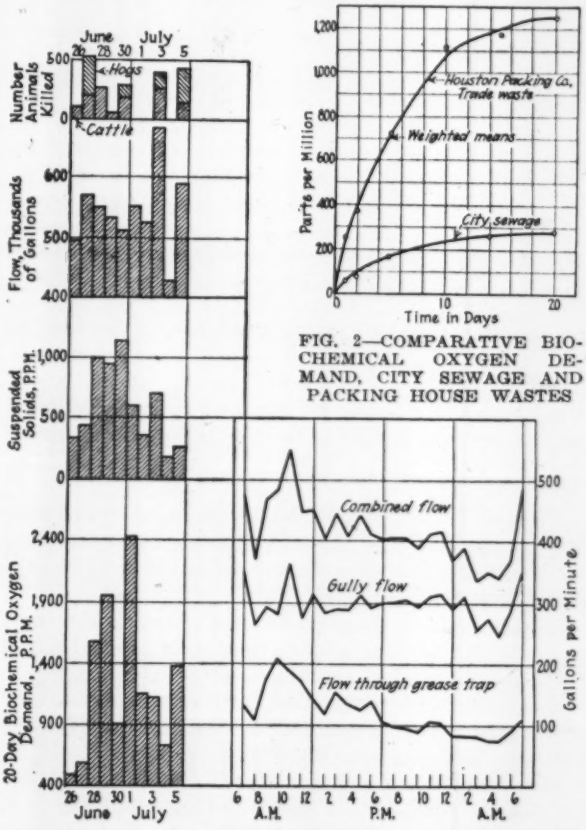


FIG. 1—ANIMALS KILLED, VOLUME AND ANALYSES OF WASTES, HOUSTON PACKING CO.
Results of studies made June 26 to July 5, 1924, on working days only.

FIG. 2—COMPARATIVE BIOCHEMICAL OXYGEN DEMAND, CITY SEWAGE AND PACKING HOUSE WASTES

cone-shaped receptacle having a tube extending close to the bottom of the tank. The vanes throw out a portion of the liquid contained therein, creating a slight head outside the receptacle, causing a vertical circulation up through the center tube.

This tank was operated as a continuous-flow, combined aeration and settling unit, making the sludge control very difficult, and for this reason some of the results are not consistent (Table II). The results as a whole, considering the character of the waste, are not unfavorable to surface aeration; however, a detention period of 36 hr. was required to give a satisfactory and consistent effluent. The horsepower requirement for the proposed plant of 0.56 m.g.d. is calculated at 48, but the manufacturer's proposal carries a guarantee of 60, or 86 and 107, respectively, per million gallons.

Diffused Air Aeration—A fill-and-draw tank was

TABLE I—ANALYSES OF PACKING HOUSE WASTES AT HOUSTON, TEXAS, MADE IN 1922.
(Results in parts per million and for working days)

	Grease Trap	Gully	Weighted Means
Total solids	6,964	898	2,613
Volatile solids	3,900	494	1,465
Fixed solids	3,064	404	1,148
Suspended solids	1,321	345	625
Volatile solids	1,145	234	496
Fixed solids	176	111	130
2 hrs. settling	545	257	348
5 day biochemical oxygen demand	1,320	486	725

Mean flow, 560,000 gal. per day.
Maximum rate of flow, 10 a. m., 790,000 gal. per day.
Average number of head slaughtered daily, 282.
Suspended solids per head, 10.5 lb.
Amount of organic suspended solids per head, 8.4 lb.

operated by diffused air, not only to compare with the surface aeration, but also for comparison with the treatment of the city's sewage by diffused air. A fill-and-draw tank is easy to control, and therefore has some advantages over surface aeration, which should be considered in comparing results.

It was determined that, for satisfactory and consistent results, 0.26 cu.ft. of free air was required for each square foot surface area of the liquid, and a detention period of not less than 12 hr. Assuming a tank with an effective depth of 10 ft. and an air compressor efficiency of 50 per cent, the horsepower requirement will be 51, or 91 per million gallons.

From these calculations it may be assumed that for an effluent of equal quality the power requirements will be the same for either method of aeration when treating a waste as concentrated as the one under consideration, but a longer period of detention is required for the surface aerator. With these requirements it was not considered that very marked economies had been obtained.

Flocculation and Oxidation—In the early experiments with activated sludge, it was pointed out that the process might for convenience be divided into two stages: (1) Flocculation, in which, with a comparatively short aerating period in the presence of well activated sludge, the colloidal and suspended matters were flocculated and settled quite rapidly, leaving a well clarified effluent, but more or less putrescible; and (2) oxidation, for when the process was extended a well oxidized effluent resulted, with complete stability.

While an effluent having a stability of 60 would meet the present conditions in the Ship Channel, it has been found difficult to control the sludge so as to operate the city plants at this low figure on account of the sludge losing its aerobic conditions, followed by a great increase in the oxygen demand of the effluent. To re-aerate the sludge before mixing with the raw waste is not altogether satisfactory and results in very little economy in the use of air.

To take advantage of the short flocculating period, and to remove as soon as possible the high oxygen-demanding sludge, it was decided to separate the two stages: (1) Flocculate; (2) settle out the sludge; (3) oxidize the effluent in another tank, aerating a sufficient length of time to maintain an aerobic sludge with which to inoculate both the flocculation and oxidation tanks, and at the same time produce an effluent with a high purification factor.

It seemed reasonable to assume that for the flocculation period the surface aerator would be as efficient as the diffused air, but with less power requirement. Experiments were conducted to determine if this assumption held true, and it was found that with 6 hr. of flocculation practically the same results were obtained by either method, but after this the purification factor curve begins to diverge, as shown by Fig. 3. The purification effected by flocculation, as judged by the biochemical oxygen demand, is about 70 per cent.

The final effluent from the oxidation tank after 2-hr. diffused air aeration on the clarified flocculated liquid had a purification factor of 97.5 per cent.

The flocculation period when working the surface aerator requires a calculated horsepower of 8 with a guarantee of 10, while the horsepower for the diffused air flocculation is calculated at 26. The requirement for the oxidation stage by diffused air is calculated at 10, making a total for aeration of 18, or 31 per m.g. This is considered very satisfactory for packing house waste.

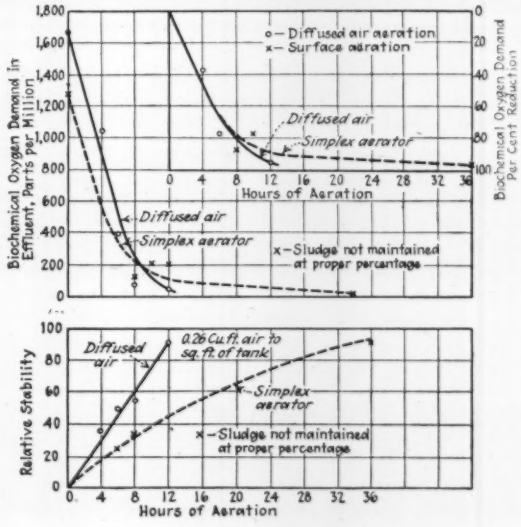


FIG. 3—COMPARATIVE ACTIVATED-SLUDGE RESULTS WITH SURFACE AND DIFFUSED AIR AERATION

Sludge Experiments—The small volume of sludge produced in the experimental units offered very little opportunity for extensive experiments in dehydrating. The standard laboratory filtering test, as used for control work in the city plants, was conducted with satis-

TABLE II—EXPERIMENTAL RESULTS WITH SIMPLEX AERATOR IN TREATING PACKING HOUSE WASTES AT HOUSTON, TEXAS

Hours of Detention	Nitrogen As Free Ammonia R	Nitrogen As Free Ammonia Per Cent of Average	Nitrogen As Free Ammonia E	Nitrogen As Free Ammonia Per Cent Reduction	Nitrogen As Nitrites R	Nitrogen As Nitrites E	Nitrogen As Nitrates R	Nitrogen As Nitrates E	Suspended Solids R	Suspended Solids Per Cent of Average	Suspended Solids E	Suspended Solids Per Cent Reduction	5-Day Biochemical Oxygen Demand R	5-Day Biochemical Oxygen Demand Per Cent of Average	5-Day Biochemical Oxygen Demand E	5-Day Biochemical Oxygen Demand Per Cent Reduction	Relative Stability	Per Cent Sludge
6.0	79	117.5	41	48.2	0	0	0	0	2546	142.0	345	86.6	1590	130.0	216	86.0	25	10
7.0	72	104.5	51	29.2	0	0	0	0	2011	112.5	1,233	38.7	1068	87.2	257	76.0	0	2
8.0	56	89.0	30	46.5	0	Tr.	0	0.22	1000	55.8	302	69.8	1075	87.7	136	87.4	34	11
10.0	64	85.6	43	32.8	0	0	0	0	1435	80.0	483	66.4	910	74.3	207	77.2	3	5
14.0	53	84.0	35	34.0	0	0	0	0	1452	81.0	438	69.8	1138	93.0	384	66.2	26	34
16.0	68	108.0	36	47.0	0	0	0	0	2247	125.5	370	83.6	1280	104.5	527	59.0	30	7
36.0	68	108.0	15	78.0	0	0.67	0	1.95	2020	112.6	119	94.2	1280	104.5	39	97.0	91	17

TABLE III—EXPERIMENTAL RESULTS WITH DIFFUSED AIR IN TREATING PACKING HOUSE WASTES AT HOUSTON, TEXAS

Hours of Aeration	Nitrogen As Free Ammonia R	Per Cent of Average	E	Per Cent Reduction	Nitrogen As Nitrites R	E	Nitrogen As Nitrates R	E	Suspended Solids R	Per Cent of Average	E	Per Cent Reduction	5-Day Biochemical Oxygen Demand R	Per Cent of Average	E	Per Cent Reduction	Relative Stability	Per Cent Sludge	*Ratio Air	†Ratio Air
4	74	116	49	33.5	0	0	0	0	2196	122.5	433	80.0	1675	136.5	1,047	37.5	37	27	1.9	.26
6	74	116	35	52.5	0	Tr.	0	0.2	2196	122.5	212	90.5	1675	136.5	397	76.5	49	27	2.7	.26
8	74	116	19	74.5	0	Tr.	0	0.5	2196	122.5	172	91.5	1675	136.5	86	95.0	55	27	3.6	.26
12	74	116	13	82.5	0	0.8	0	1.6	2196	122.5	119	94.5	1675	136.5	91	95.0	91	27	5.4	.26
12	62	98.4	14	77.5	0	1.1	0	1.8	2192	122.4	205	90.5	1545	126.0	16	99.0	79	19	4.9	.22
12	57	90.4	39	31.5	0	0	0	0	2151	120.0	341	84.0	1943	158.6	154	92.0	0	4.4	2.2	.10
12	87	138	38	56.5	0	0	0	0	2005	112.0	448	78.0	1675	136.5	146	91.0	54	14	3.1	.14
18	63	100	31	51.0	0	0	0	0	2270	127.0	459	80.0	1362	111.0	153	89.0	47	18	3.5	.11
24	57	90.4	29	49.0	0	Tr.	0	0	1685	94.0	352	79.0	1344	109.6	156	88.5	29	7	4.5	.10
24	61	96.8	33	46.0	0	Tr.	0	Tr.	2158	120.5	331	85.0	1273	103.8	173	86.5	12	22	6.2	.14
After 7 Hours Flocculation with Simplex Aerator																				
2.0	73	116	23	68.5	0	0.56	0	0.70	2258	126	92	96	1312	107.0	25	97.5	70	13.6	0.7	.18
2.0	73	116	51	30.0	0	0	0	0	2193	122	515	76.5	1217	100.5	171	86.0	38	28.9	0.5	.13

* Ratio of air in cu.ft. to gallon of waste. † Ratio of air in cu.ft. a minute to square foot of surface.

factory results and it was determined that conditioning similar to that used on Houston city sludge will be necessary. A satisfactory filtering rate was obtained with approximately the same quantity of reagents as used at the Houston plants. The appearance of the physical condition was also indicative of easy dehydrating qualities. The dried sludge indicates that not less than 7 per cent ammonia and 3 per cent phosphoric acid is to be expected, making a valuable base for fertilizer.

Proposed Design for Plant—The proposed flow sheet is shown by Fig. 4. The waste from the slaughter and dressing rooms is to be collected in the existing system and passed through the grease collector, as at present. From the grease collector it will pass, after connecting to other waste lines, to a primary settling tank, or Dorr clarifier, equipped with a secondary grease skimmer. By means of this unit it is expected that 50 per cent of the solids will be removed and 25 per cent of the oxygen demand. The effluent from this tank will then be flocculated, using the simplex surface aerator and 6-hr. detention. After flocculation the sludge will be settled, the effluent passing to an oxidation tank having 4-hr. detention, and finally through another clarifier. It was concluded to use air on the oxidation tank, at least for the present, on account of the more positive control of the sludge and faster oxidation; however, surface aeration can be installed at a later date, if found advisable. The tanks will be designed to allow one-third of the flow to be returned as inoculating sludge.

Although it is not believed that fine screening will be necessary the hydraulics of the plant will be designed to permit an installation of screens if found desirable.

Sludge Disposal—All the sludge from the oxidation tank will be returned to aerating tanks. All surplus will be removed from the primary and flocculation clarifiers. The expected moisture in the primary sludge is 92 per cent and in the flocculated sludge 98 per cent. For successful drying the moisture should not exceed 80 per cent. Reduction to this extent will be expected by conditioning with sulphur dioxide gas, filtering through a MacLachlan-Decker type of machine, with couch roll operation to give high capacity and a moisture of 87 per cent. At this moisture content the material can readily be mixed with the tankage for hydraulic pressing, as now used, reducing the moisture to the desired point. Present drying equipment will dry the mixed sludge and tankage cake to a moisture content of 10 per cent.

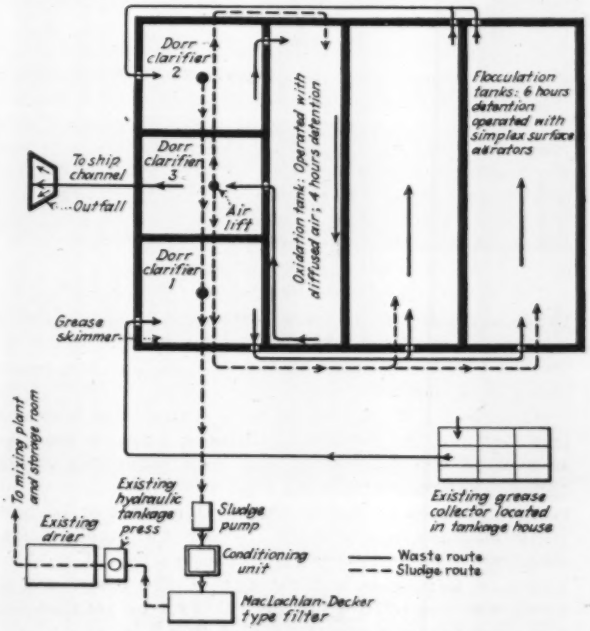


FIG. 4—FLOW SHEET FOR PROPOSED ACTIVATED-SLUDGE PLANT, HOUSTON PACKING CO.

At the present rate of killing it is estimated that a daily average of 1.8 tons of dry sludge will be produced, with 4 tons in 1930.

In the design of the plant it will be assumed that the water consumption will increase very little, but that the concentration of the waste will be in almost direct proportion to the number of animals killed. Under this condition the treatment plant will meet the 1930 requirements.

Acknowledgment is due W. S. Stanley, chemist, who assisted in the field and laboratory control during the experiments.

TABLE IV—ESTIMATED DAILY OPERATING COST OF ACTIVATED-SLUDGE PLANT FOR PACKING HOUSE WASTES, AT HOUSTON, TEXAS.

	Present Conditions	In 1930
Power, all units, @ 0.01½c. per kw-hr.	$6.70	$7.50
Sulphur, @ $20 per ton	2.00	4.00
Extra labor @ $4	8.00	16.00
Miscellaneous	5.00	7.50
Drying	10.00	21.00
	$31.70	$56.00
Sludge value, 1.8 tons @ $20	36.00	
Sludge value, 4 tons @ $20		80.00

Tests of Leakage, Friction and Discharge in Norfolk Supply Main

By W. H. Taylor and Norman Z. Ball
Director Public Works and Engineer Water and Sewers, Norfolk, Va.

THE NEW 30- and 36-in. concrete, continuous wood-stave and cast-iron supply main completed two years ago for the water-works of Norfolk, Va., offers exceptional opportunities for determining leakage, discharge and friction losses. The following notes give the result of recent tests to determine these values. It is planned to repeat these tests yearly. The leakage averaged 49 gal. per inch-mile per day. Rates of flow and values of C in the Hazen & Williams formula for the various kinds of pipe are given at the close of this article.

Leakage—Against a closed valve at the lower end of the line (the first valve beyond the city limits) and the check valve at the pumping station, the leakage in 90,000 lin.ft. of 30- and 36-in. line was determined by displacement in a 10-ft. surge tank located on a summit in the line near the pump house. This leakage was 49 gal. per inch diameter of pipe per mile per day, under the average pressure of the line when delivering 12 m.g. daily.

Friction Losses and Discharge—Five sections of the line comprising 73,750 ft. of the total 98,000 ft. of the line were selected for the investigation of the friction losses; two of concrete, two of wood and one of cast iron. The four sections of concrete and wood are relatively straight, without either vertical or lateral deflection of magnitude. The section of cast iron is the most irregular, with slight curvatures and two 45-deg. bends; and in the midst of this section is located the surge tank, with 30-in. connections thereto.

The rate of flow through the pipe was read on the rate-of-flow dial of the venturi meter at the pumping station. The meter was checked before and after the test—a slight correction in the rate of flow was ascertained and applied.

At each end of the section to be tested, taps had been provided and the horizontal distance between the taps as well as elevation above sea level accurately determined. The pressure in the pipe was determined simultaneously at each end of the section by two parties, using mercury manometers. These manometers consisted of a mercury reservoir constructed of a short length of 2-in. pipe and fittings, to the lower end of which was connected a flexible rubber hose terminating in a glass tube. From the top of this 2-in. pipe a connection was made with the tap in the main. Before water was allowed to enter the mercury reservoir, a certain portion of the glass tube, flexible rubber hose and the lower portion of the reservoir were filled with mercury and its level carefully noted. When the pressure was applied by water entering the reservoir, the glass tube was raised, keeping the mercury at the same point in it. The flexible hose permitted this to be done.

Readings of the elevation of the mercury were made at five-minute intervals over a period of a half hour. The difference in mercury level, converted into the equivalent head of water, added to the height of the mercury in the reservoir above the pipe gave the elevation of the hydraulic grade line, the pipe elevation having been previously determined.

The following values of C were found:

Test	Material	Size Inches	Length Feet	Flow M.G.D.	C
1	Concrete.....	36	11,464	13.2	140.4
2	Redwood.....	36	39,580	13.2	138.7
3	Concrete.....	36	13,071	13.2	137.6
4	Cast Iron.....	30	4,929	10.2	105.9
5	Redwood.....	30	4,706	10.2	140.0

In view of the number of observers required to make simultaneous readings at so many different points and the length of time required, the work was done on Sundays. The writers were assisted by Charles H. Bliven, superintendent of the water department, E. H. Herbert, engineer of the pumping station, and his assistant.

Comparative Tests on Piles Basis for Selecting Best Type

IN ORDER that the selection of the type of piling to be used in future harbor work at Los Angeles harbor may be based on definite data compiled under local and comparative conditions, a series of tests is planned which it is hoped will lead to definite conclusions on this subject.

The patentees of several types of piles have been invited to participate in these tests in accordance with a plan which will share the cost on an approximately equal basis between the patentee and the Los Angeles harbor commission. The test is to include creosoted wood piles, poured concrete piles, duocrete piles, Raymond concrete piles, gunite piles, and perhaps some other patented concrete designs. Of the foregoing, those types not proposed by a patentee are to be made by the commission.

Three full-size piles of each type are to be built by the patentees, using materials furnished by the harbor department. Two of the three piles of each type will be driven in the hardest bottom known to exist in the harbor, and will be later pulled and examined. The third pile of each type is to be tested in cross bending to destruction in a machine which the harbor department has equipped for this purpose. In addition to the tests on full-size piles, extra specimens, for the most part 6x6x12 in. in size, made of the same material as the several types of piles, are to be given a series of laboratory tests including compression, repeated loads, static loads, permeability, bond test, density and absorption, maximum resistance to bending and a test of the ratio of E_s to E_c.

Except for the driving test in the harbor all tests will be conducted in the laboratory of the harbor department and will be open to the inspection of all parties interested as well as representatives of the leading technical societies and of the California Institute of Technology with which arrangements have been made to assist in the tests. Specifications under which the various interested parties will be permitted to furnish samples have been issued by the harbor commission.

It is not expected that these tests can be completed until about June 1. The data when compiled will be used by George F. Nicholson, chief engineer, and Gen. Lansing H. Beach, consulting engineer, Los Angeles Harbor Commission, as the basis of a report which is to recommend the preferable type of pile for future extension of Los Angeles harbor improvement.

The Panama Canal—Its Present and Future Traffic

Size of Locks in Relation to Vessels Using the Canal—Recent Traffic Figures—Estimated Maximum Capacity

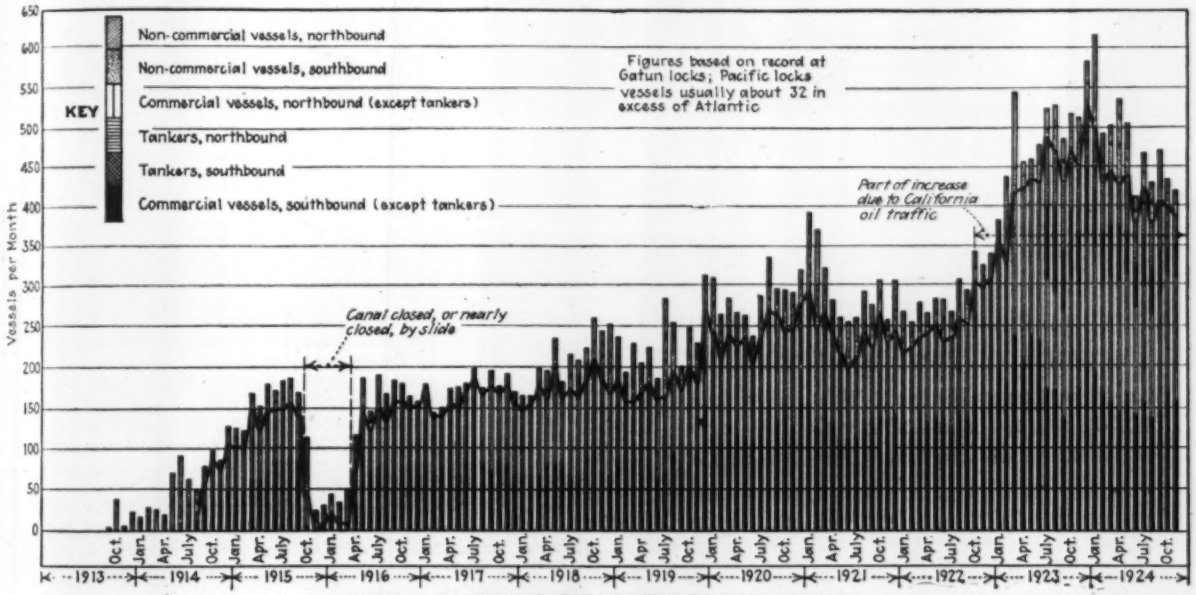
By R. Z. Kirkpatrick
Chief Hydrographer, Panama Canal, Balboa Heights, C. Z.

THE LARGEST ships that have transited the Panama Canal are the British warships *Hood* and *Repulse* on last July 23 and 24. The *Hood* is 860 ft. 7 in. long, has a beam of 105 ft. 2½ in. and a displacement of 44,799 tons; the *Repulse* is 794 ft. 4½ in. long, beam 102 ft. 8 in., displacement of 35,359. The tolls were $22,399 and $17,679 respectively. Inasmuch as the lock chambers are 110 ft. wide, the passage of these ships is of special interest, since there was a clearance of but 2 ft. 4¾ in. on each side. The usable length of locks, 1,000 ft., left 70 ft. clearance fore and aft between the *Hood* and the lock gates.

The greatest beam of these ships was below water. In passing through the locks outriggers of poles, attached vertically to booms, were placed on each side to indicate to the pilot the full ship beam, and seamen were stationed opposite the outriggers, with signal flags to indicate to the pilot when ship was closer than 2 ft. to the wall. Eight towing locomotives were used, 4 to a side. The transit of the canal was without incident, the vessels handling well.

On Dec. 12 the Red Star Line tourist ship *Belgenland* transited the Panama Canal. In many respects this is the largest commercial vessel using the canal to date. It is 670 ft. long against 675 ft. 4 in., the length of the *Mount Vernon* which transited Oct. 19, 1919; is 78 ft. in beam against 77.9 ft. for *Empress of Canada*, transiting on Jan. 17, 1924; was 27,132 tons registered gross, 15,352 tons registered net, 18,874 tons Panama Canal net, and paid $16,412 in tolls as against 22,622 tons registered gross, 13,637 tons net, 16,959 tons Panama Canal net, and $16,855 tolls for steamer *America*, transiting on Feb. 6, 1920. Thus the *Belgenland*, while not paying highest tolls, established new records for commercial vessels for beam, registered gross and net and Panama Canal net tonnage.

Canal Traffic—The fiscal year ending June 30, 1924, was by far the most prosperous in the history of the Panama Canal. The net income from transit revenue (tolls and miscellaneous) was $16,307,948 as compared with $10,001,066 in 1923 and $3,466,574 in 1922; the net profit from auxiliary business operations (shops, storehouses, oil stations, etc.) was $901,624 as compared with $1,140,642 in 1923. Panama Railroad Co. business, exclusive of steamship line (including coaling plants, docks, cattle industry and commissaries) showed profit of $1,044,887 as compared with $922,171 in 1923. In all, the net profit to the United States was $18,254,459. During the year 5,230 ships, exclusive of public vessels exempt from tolls transited the canal, with aggregate net tonnage of 26,148,878, paying $24,290,963, which is 38.7 per cent greater than 1923.



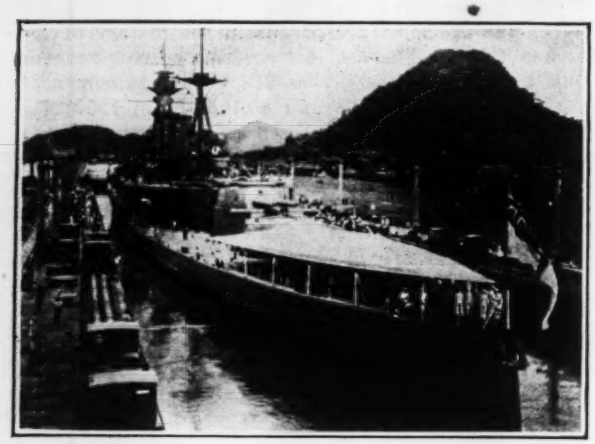
VESSELS PASSING GATUN LOCKS TO END OF 1924

From the opening of the canal in 1914 to July 1, 1924, $97,802,818 tolls have been collected and 107,910,991 tons of cargo in 25,032 ships have transited the canal. Above all operation and maintenance expense, $33,241,425 has been netted, this in spite of deficits in 1914, 1916 and 1917.

One interesting feature in the canal's operation is the progressive increase in size of the average ship, in tolls and cargoes. In 1921, 1922 and 1923 the average registered net tonnage per vessel was progressively 3,311, 3,440 and 3,957 tons, with tolls of $4,042, $4,195 and $4,559. This increase is mostly due to ore and tank ships. In 1924, 32.6 per cent of all commercial transits were tankers, paying $9,071,835 tolls. This traffic is now falling off somewhat.

A peculiar swing in the Panama Canal traffic occurred Nov. 18, 1924, a mere freak of chance. But four ships transited the canal. Two of these, being Army or Navy boats, were "deadheads" and the two commercial ships were so small their net tonnages yielded but $2,865 tolls for the day. The average tolls per commercial ship for the 4,102 transits, up to Nov. 1, was approximately $4,672.

Capacity of the Canal—The ultimate capacity of the locks and water supply is probably about 48 lockages a day. By making many tandem and two-short-ships-to-a-chamber lockages, 60 ships a day can easily be passed through the canal. Inasmuch as the 5,230 ships in the fiscal year 1924 is but 14.33 a day, there is yet a great margin of safety before the present canal is outgrown.



H. M. S. HOOD IN PEDRO MIGUEL LOCK, PANAMA CANAL

Chicago Sanitary District Issued Permit to Divert 8,500 Sec.-Ft.

War Department Requires Sewage-Works for 1,200,000 Population, 90 Per Cent Metering, Control of Chicago River Flowage

ON March 7 the Secretary of War made public the provisions of a five-year permit granted the Sanitary District of Chicago covering diversion of water from Lake Michigan. The features of the permit are diversion of an annual average of 8,500 sec.-ft. of water, the "instantaneous maximum" not to exceed 11,000 sec.-ft. (this is in addition to the water Chicago draws for water supply—about 1,200 sec.-ft. in 1924); submission by the Sanitary District for the approval of the Chief of Engineers and the Secretary of War plans for controlling works to prevent the discharge of the Chicago River into Lake Michigan in times of flood; execution of a sewage-treatment program (artificial processes) providing for treatment, by the expiration of the permit, of sewage for 1,200,000 persons; and adoption of a program within six months from date of permit for metering 90 per cent of Chicago's water service, with meter installations of 10 per cent per annum.

Permit provisions follow closely the recommendations made to the Chief of Engineers by Major Rufus W. Putnam, Corps of Engineers, district engineer at Chicago. Particular attention was called in Major Putnam's report to the fact that diversion means actual water taken by the district through its main drainage canal and channel auxiliaries. This, added to the 1,200 sec.-ft. discharged by the sewers, amounts to 9,700 sec.-ft., which controlled flow is to be measured at Lockport. (The district asked for 10,000 sec.-ft. at Lockport.)

It is believed that execution of the artificial sewage-disposal program in accordance with terms of the permit will relieve the load on the drainage canal so that a reduction to 7,250 sec.-ft., or even lower, may be possible, by 1929. This, Major Putnam's report asserts, looks to the reduction in diversion to 4,167 sec.-ft. by 1935. The "instantaneous maximum" of 11,000 sec.-ft. may be continued until works are installed to prevent reversal of flow of the Chicago River.

The text of the permit, together with Major Putnam's indorsement, follows:

NOTE.—It is to be understood that this instrument does not give any property rights either in real estate or material, or any exclusive privileges; and that it does not authorize any injury to private property or invasion of private rights, or any infringement of federal, state, or local laws or regulations, nor does it obviate the necessity of obtaining *state assent* to the work authorized. It merely expresses the assent of the federal government so far as concerns the public rights of navigation. (See Cummings v. Chicago, 188 U. S. 410.)

Permit

WHEREAS, By Section 10 of an Act of Congress, approved March 3, 1899, entitled "An Act making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes," it is provided that it shall not be lawful to build or commence the building of any wharf, pier, dolphin, boom, weir, breakwater, bulkhead, jetty, or other structures in any port, roadstead, haven, harbor, canal, navigable river, or other water of the United States, outside established harbor lines, or where no harbor lines have been established, except on plans recommended by the Chief of Engineers and authorized by the Secretary of War; and it shall not be lawful to excavate or fill, or in any manner to alter or modify the course, location, condition or capacity of any port, roadstead, haven, harbor, canal, lake, harbor of refuge, or inclosure within the limits of any breakwater, or of the channel of any navigable water of the United States, unless the work has been recommended by the Chief of Engineers and authorized by the Secretary of War prior to beginning the same;

AND WHEREAS, Application has been made to the Secretary of War by *The Sanitary District of Chicago, Illinois*, for authority to divert an annual average of 10,000 cu. ft. of water per second from Lake Michigan through the channels of said Sanitary District;

AND WHEREAS, In the judgment of the Secretary of War, an annual average diversion of more than 8,500 cu. ft. per second should not now be permitted;

NOW THEREFORE, this is to certify that, upon the recommendation of the Chief of Engineers, the Secretary of War, under the provisions of the aforesaid statute, hereby authorizes the said Sanitary District of Chicago to divert from Lake Michigan, through its main drainage canal and auxiliary channels, an amount of water not to exceed an annual average of 8,500 cu. ft. per second, the instantaneous maximum not to exceed 11,000 cu. ft. per second, upon the following conditions:

1. That there shall be no unreasonable interference with navigation by the work herein authorized.

2. That if inspections or any other operations by the United States are necessary in the interest of navigation, all expenses connected therewith shall be borne by the permittee.

3. That no attempt shall be made by the permittee or the owner to forbid the full and free use by the public of any navigable waters of the United States.

4. That the Sanitary District of Chicago shall carry out a program of sewage treatment by artificial processes which will provide the equivalent of the complete (100 per cent) treatment of the sewage of a human population of at least 1,200,000 before the expiration of the permit.

5. That the Sanitary District shall pay its share of the cost of regulating or compensating works to restore the levels or compensate for the lowering of the Great Lakes system, if and when constructed, and post a guarantee in the way of a bond or certified check in the amount of $1,000,000 as an evidence of its good faith in this matter.

6. That the Sanitary District shall submit for the approval of the Chief of Engineers and the Secretary of War

plans for controlling works to prevent the discharge of the Chicago River into Lake Michigan in times of heavy storms. These works shall be constructed in accordance with the approved plans and shall be completed and ready for operation by July 1, 1929.

7. That the execution of the sewage treatment program and the diversion of water from Lake Michigan shall be under the supervision of the U. S. District Engineer at Chicago, and the diversion of water from Lake Michigan shall be under his direct control in times of flood on the Illinois and DesPlaines Rivers.

8. That if, within six months after the issuance of this permit, the city of Chicago does not adopt a program for metering at least 90 per cent of its water service and provide for the execution of said program at the average rate of 10 per cent per annum, thereafter, this permit may be revoked without notice.

9. That if, in the judgment of the Chief of Engineers and the Secretary of War, sufficient progress has not been made by the end of each calendar year in the program of sewage treatment prescribed herein so as to insure full compliance with the provisions of condition 4, this permit may be revoked without notice.

10. That this permit is revocable at the will of the Secretary of War, and is subject to such action as may be taken by Congress.

11. That this permit, if not previously revoked or specifically extended, shall cease and be null and void on Dec. 31, 1929.

WITNESS my hand this 3rd day of March, 1925.

H. TAYLOR,
Major General,
Chief of Engineers.

WITNESS my hand this 3rd Day of March, 1925.

JOHN W. WEEKS,
Secretary of War.

1st Indorsement

U. S. Engineer Office, Chicago, Ill., March 2, 1925—To the Chief of Engineers, Washington, D. C.

1. This is an application from the Sanitary District of Chicago, a municipality created under the laws of the State of Illinois, to divert 10,000 cu.ft. per second of water from Lake Michigan, for the purpose of keeping the sewage of that locality from contaminating its water supply and for reducing the sewage by dilution.

2. This question of the diversion of water from Lake Michigan has been so thoroughly investigated by the Department and discussed at such great length in various reports that it is not believed advisable to enter into any descriptive or historical review before presenting the recommendations which are to follow. Detailed information of this character may be found in the report entitled "Diversion of Water from Lake Michigan," which was submitted by this office on Nov. 1, 1923.

3. This application is prompted by the action of the United States Supreme Court on Jan. 5, 1925, by which it sustained the position taken by the Local United States Court, requiring adherence to the limitations placed by the Secretary of War on the amount of the diversion. The local authorities are faced with the alternative of a reduction in the amount of diversion to 4,167 cu.ft. per second by March 5, 1925, or relief from Congress or the War Department.

4. In the issuance of a permit, the exact meaning of the word "diversion" should be understood. In the recommendations which follow, by diversion is meant the amount of water which is actually withdrawn from Lake Michigan by the Sanitary District of Chicago through its main drainage canal and auxiliary channels, and is not inclusive of the amount flowing in the channels which come from the sewers of the locality. In other words, "diversion" is taken to be the gross flow at Lockport, less the amount of water used by the city of Chicago for domestic purposes.

5. It is recommended that a permit be issued to the Sanitary District of Chicago, covering a period of five years, to divert from Lake Michigan, through its main drainage canal and auxiliary channels, an amount of water not to exceed an annual average of 8,500 cu. ft. per second; the instantaneous maximum not to exceed 11,000 cu. ft. per second. This permit should be made conditional upon the following:

(1) The Sanitary District of Chicago shall carry out a program of sewage treatment by artificial processes which will provide the equivalent of the complete (100 per cent) treatment of the sewage of a human population of at least 1,200,000 before expiration of permit.

(2) The Sanitary District shall pay its share of the cost of regulating or compensating works to restore the levels or compensate for the lowering of the Great Lakes system, if and when constructed, and post a guarantee in the way of a bond or certified check in the amount of $1,000,000 as an evidence of its good faith in this matter.

(3) The Sanitary District shall submit for the approval of the Chief of Engineers and the Secretary of War plans for controlling works to prevent the discharge of the Chicago River into Lake Michigan in times of heavy storms. These works shall be constructed in accordance with the approved plans and shall be completed and ready for operation by July 1, 1929.

(4) The execution of the sewage treatment program and the diversion of water from Lake Michigan shall be under the supervision of the U. S. District Engineer at Chicago, and the diversion of water from Lake Michigan shall be under his direct control in times of flood on the Illinois and DesPlaines Rivers.

(5) If, within six months after the issuance of this permit, the city of Chicago does not adopt a program for metering at least 90 per cent of its water service and provide for the execution of said program at the average rate of 10 per cent per annum thereafter, this permit may be revoked without notice.

6. The average diversion from Lake Michigan during 1924 by the Sanitary District has been approximately 8,500 cu. ft. per second. This diversion combined with the discharge from the sewers of the locality produces a total flow at Lockport of about 9,700 cu. ft. per second. This so closely approximates the *flow* necessary to safeguard against reversals of the river into the lake in times of storm (10,000 cu.ft. per second) that a permit for *diversion* of 8,500 cu. ft. per second will suffice in this regard. No obligation appears to rest with the Department to prevent any increase in pollution of the Illinois and DesPlaines Rivers; the maintenance of *status quo* as regards amount of diversion will place the burden of relieving the lower river situation upon the Sanitary District. Until the controlling works (Condition 3) are completed, ample protection against the dangers of a reversal of the river is provided by the authority to divert an instantaneous maximum of 11,000 cu. ft. per second.

7. Condition 1 as proposed provides for the execution of a sewage treatment program which will relieve the load on the Drainage Canal by the equivalent of a population of 1,200,000. Compliance with this condition will make possible a reduction in amount of diversion to 7,250 cu. ft. per second or lower by the end of 1929. This condition looks to a reduction to 4,167 cu. ft. per second by 1935.

8. It might be considered preferable to substitute the following condition for the one proposed so that definite yearly performance might be prescribed closely as possible:

> 1. That the Sanitary District of Chicago carry out the following program of artificial sewage treatment of a degree sufficient to produce aggregate results equivalent to complete (100 per cent) treatment of the sewage of a human population of at least 1,200,000.
>
> [*Here follows a schedule of recommended construction covering each of the five years, of which the permit makes no specific mention.*]

9. This condition is not recommended however. It would be quite impractical to enforce for there would be many changes to be made in the program during the course of its execution, and each change would require the approval of the Secretary of War and the Chief of Engineers, and perhaps the rewriting of the permit. If condition 1 is couched in the more general terms recommended, it is proposed to inform the Sanitary District that the performance expected of them will be as outlined in detail in paragraph 8, and this would permit minor departures to be authorized promptly as they were necessary.

10. The estimated cost of the proposed program is approximately $54,192,000. The present bonding power of the Sanitary District (3 per cent of the assessed valuation) is insufficient to finance this program; however, legislative authority may be obtained to increase this rate to 5 per

cent—the constitutional limitation. The estimated revenue from bonds on this basis (including reissues) to Dec. 31, 1929, is $66,240,000.

11. Condition 2 merely obligates the Sanitary District to pay its proper share of works to restore the levels or compensate for the lowering of the Great Lakes system should such works be constructed. It does not commit the Department to any particular plan nor to the general proposition of restoration of lake levels. The posting of the guarantee will not embarrass the Sanitary District financially nor interfere with the execution of the sewage-treatment program.

12. Condition 3 is considered necessary to permit an ultimate reduction of the diversion to 4,167 cu. ft. per second. Controlling works of some sort will be required to keep the Chicago River from discharging into Lake Michigan in times of flood, and at least two types have been suggested which are believed to be practical.

13. The provision with reference to metering of the water service of the city of Chicago is included for three reasons:

(a) There will be a substantial saving in the cost of construction and operation of sewage treatment plants due to the decreased amount of sewage to be treated.

(b) There will be substantial reduction in the amount of lake water used for domestic purposes.

(c) It will be possible for the city of Chicago to finance a filtration system for its water supply when its water consumption is reduced to a reasonable amount. When the water supply is filtered, the dangers incident to an occasional reversal of the Chicago River will be entirely eliminated.

14. A shorter time limit for the permit is not recommended as results produced by the end of 1927, for instance, will not permit a reduction in the amount of the diversion, which it is believed should be required in any renewal, no matter when it is made. Furthermore, sufficient performance can not be prescribed for a shorter period to insure completion of a larger program looking to a reduction in diversion to 4,167 cu. ft. per second by 1935.

RUFUS W. PUTNAM,
Major, Corps of Engineers, District Engineer.

Tide Staff Designed to Meet Exacting Conditions

Movable Staff Provided With Fixed Guides and Clamp Against Buoyancy—Copper Sheathing Protects From Teredos

BY D. L. PARKHURST
Chief, Instrument Division, U. S. Coast and Geodetic Survey, Washington, D. C.

THE determination of tidal planes, of considerable importance to engineers engaged on marine work and harbor improvements, is accomplished by use of automatic recording tide gages which draw graphs accurately indicating the rise and fall of the tide at a given point at all times, mean sea level and other planes being derived by analysis of the curve. The tidal curve, as drawn by the gage, is referred to the tide of nature by means of frequent comparative readings of a fixed tide staff whose graduations are definitely located with respect to a permanent bench-mark.

The design of a satisfactory tide staff has presented an interesting problem, and its solution, as worked out by the U. S. Coast and Geodetic Survey, is as follows: The staff consists of a board about ¾ in. in thickness, 4 in. in width and from 12 to 16 ft. in length, hinged in the middle for convenience in handling. The board is painted white and is graduated with narrow black lines in feet and tenths.

The staff is held in brass guides on a plank backing-piece which is permanently fastened to a wharf or other suitable object. The staff is inserted into the guides only at the time at which reading is to be made, as the graduations soon become obscured by oil or scum if the staff is not removed and cleaned.

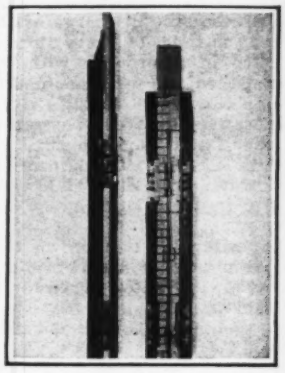


FIG. 1—IMPROVED TIDE STAFF
White staff in brass guides mounted on copper sheathed fixed backing-piece.

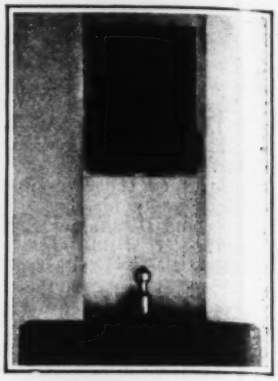


FIG. 2—BACK OF TIDE STAFF
Recess casting, above, and stud-plate on backing-piece, below.

In order to damp out the effect of small waves when reading, a glass tube of ½-in. bore is attached to the staff by spring clips.

To counteract the effect of buoyancy, an ingenious device has been designed to supplant the cumbersome lead weight which was formerly attached to the lower end of the staff and which was the cause of frequent breakage of the staff in handling. This device is shown in Fig. 2 and consists of a plate bearing a pointed, grooved stud securely fastened to the backing-piece and a casting carrying two spherical-ended plungers reacting against springs, which is fastened to the staff. As the staff is inserted in the guides and pushed down to its correct position, the pointed stud pushes these plungers apart until the casting reaches the seat formed by the stud-plate, when the plungers snap into the groove and securely hold the staff in place against the effect of buoyancy. A slight difference in the location of the center lines of the groove and the plungers is made so that the springs tend to force the staff down against its seat on the stud-plate. When removing the staff, a sharp jerk is sufficient to detach it from the stud.

This device has proven very effective, has entirely eliminated the breakage of staves, and eliminates any uncertainty as to the zero of the staff.

In warm salt water, where the backing-piece is exposed to the action of teredos, it is necessary to provide protection against these destructive insects. It has been found that creosote and copper paint only retard their action temporarily, and the Coast and Geodetic Survey now encases the backing-pieces entirely with sheet copper closely nailed along all seams with copper nails, and, as an added safeguard, the wood is thoroughly painted with copper paint before the sheathing is applied.

Over 5,000,000 Russians Have Malaria

Statistics submitted to the Third Russian Malaria Congress on Feb. 4 showed over 5,350,000 cases of malaria in Soviet Russia, according to a press dispatch. This is double the cases for 1913. The districts most affected are the lower Volga, the Ural in Siberia and the Ukraine.

Letters to the Editor

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

Concrete Guns in the Queensborough Subway

Sir—Referring to *Engineering News-Record*, Feb. 26, 1925, p. 342, in which you describe the concrete guns used in the Queensborough tunnel as of Ransome manufacture, this is misleading as these machines are rented to the Powers-Kennedy Contracting Corporation by the Pneumatic Concrete Machinery Co., of Newark, which holds patents on this particular type of equipment. There are three machines on the Queensborough tunnel extension and all three were manufactured by this company. We also have a number of the same machines throughout the Eastern section.

These machines are the result of over fourteen years' engineering experience—eight years by this company and six years previous by its precedessor or the Concrete Placing Co.

F. J. KICH,
Newark, N. J., General Manager, Pneumatic Concrete
March 7, 1925. Machinery Co.

Highway Signs and Angle of Vision

Sir—L. E. Moore in his article in *Engineering News-Record* Jan. 22, 1925, p. 140, has touched very opportunely upon one of the properties of the human eye that is well known to the oculist although only occasionally mentioned in literature. The angle of distinct vision corresponding to the macular area of the retina is the only portion where distinct vision can be obtained. It represents a visual angle of 8 to 9 deg.

It is the belief of the writer that the central vision of the motorist is not commonly directed at just 4 to 4½ deg. below the horizontal as Mr. Moore implies but frequently is much nearer to the horizontal so that the upper part of this cone of distinct vision will usually include two or three degrees above the horizontal. In general the greater the speed the more nearly the vision will be directed toward the horizontal. Consequently the angle of distinct vision will take in signs, signals, etc., that are placed 12 to 15 ft. above the street when 200 to 300 ft. away and this is about the distance it is desirable to have such signals recognized.

There is another property of the eye closely related to the one just mentioned that has a further bearing on the subject. In the region surrounding this distinct vision area any sharp contrast such as a bright light or a moving object instantly attracts the attention and the eye muscles act automatically pulling the eye around so that the image of this object whatever it may be falls within the distinct vision area. This action takes place involuntarily, without any conscious effort on the part of the observer particularly if the object attracting the attention is only a few degrees outside this angle of distinct vision so that for practical purposes a bright light as a signal placed anywhere within about 10 deg. of the direction in which the motorist generally directs his attention will be readily seen and recognized. The brighter the light, the more it will compel attention and a flashing light will likewise be seen better than the same intensity in a steady beam provided the period of the flash and the interval between flashes are correctly adjusted. Since it is contrast that plays such an important part the background against which the signal is seen should receive careful attention. A dark uniform background will provide a maximum contrast and increase visibility while a light uneven background will considerably reduce the perceptibility of the signal. The proper height and proper location of such signals are of equal importance with the proper design of the signal unit itself. If a traffic signal is placed so that it is seen nearly in line with a more distant street lamp or store light it will be unsatisfactory after nightfall, at best; the approaching motorist will either not see the signal at all or may easily misread its message. Colored lights are particularly valuable as signals because they are unusual and stand out clearly as sharp contrasting spots or points and if the colors are clear, bright and so standardized that the significance of each color is the same everywhere they form a most valuable adjunct to the signal equipment.

RICHARD B. HUSSEY
Street Lighting Engineering Department,
West Lynn, Mass., General Electric Co.
Feb. 11, 1925.

Col. Cooper on the Rio Cobre Plant

Sir—The information you are giving engineers (on p. 440 of this issue,) about the unheard-of flood in the Rio Cobre River, Near Kingston, Jamaica, is a valuable addition to our knowledge as to unusual discharges that at times occur in the history of rivers.

The Rio Cobre plant was finished twenty-six years ago, and, as far as I know, was the first attempt at long distance transmission of water for power purposes under a moderately low operating head.

The entire installation, including dam, pipe line, power house and its contents, cost only $160,000, and every economy had to be practiced throughout the design. If in 1897 or 1898—the time the work was built—we had known we had to face the amount of flood that has recently been in evidence, the plant would not have been built at all, because there would not have been money enough to build it safely. This plant, however, has long since earned the right to be entirely put in the scrap pile, and I am surprised to find that the damage in this extraordinary visitation was as low as $25,000.

HUGH L. COOPER.
New York City,
March 4, 1925.

Vitrified Pipe for Small Water Supplies

Sir—P. T. Hyland of Toronto, Ont., in a recent letter (*Engineering News-Record*, Feb. 19, p. 330) requested opinions on vitrified clay pipe for use in connection with small water-supply systems.

I do not consider vitrified clay pipe as satisfactory for supply lines for water-works. My principal reason for this opinion can be explained by a recent occurrence at Brigham City, Utah, where a tile pipe supply line was furnishing water to a municipal water-works system and one case of typhoid on ground which drained toward this line caused approximately one hundred cases in Brigham City. This line has now been replaced with cast iron and no contamination has been known since.

The city of Price, Utah, also has several miles of tile pipe supply line which is leaking badly in places and for the last few years has caused considerable trouble. The frost action of the ground cracks the cement joints and causes leakage.

In case it is necessary to use vitrified tile on account of the expense of other kinds of pipe, I believe it would be advisable to use some of the bituminous compounds on the market for jointing material instead of cement.

C. E. PAINTER,
Vice-President and Consulting Engineer,
Waterworks Equipment Co.
Salt Lake City, Utah,
Feb. 25, 1925.

Sir—Referring to the request of P. T. Hyland in your issue of Feb. 19 for information in regard to using vitrified pipe under pressure, my advice is to dig it up and relay, using mineral rubber (asphaltum) instead of cement. On two occasions, I tried to use vitrified pipe for inverted siphons to carry drainage water under canals, with say 2 ft. of dirt fill over the pipe. The average pipe layer, laying with cement, makes a nice job above but in nine joints out of ten does not fill the bottom. Several joints can be made with the pipe set vertically on the ground and the asphalt poured in on the jute. The sections then are laid in the trench and joined the same as lead joints. The asphaltum joint allows for considerable settlement without breaking. I would almost say never lay virtrified pipe with cement joints.

On the Grand Valley Reclamation Project in Colorado the ground settles under irrigation, as much as 6 ft. to my knowlege, which leads to all kinds of leakage troubles in culverts; here asphaltum was used with good success..

Klamath Falls, Ore., JOHN C. CLEGHORN,
Feb. 26, 1925. Civil Engineer and Surveyor.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Reclamation Appropriations Pass; Kendrick Bill Fails

Expenditures of Nearly Ten Millions Authorized with State-Aid for Some Projects

Washington Correspondence

In the last days of the 68th Congress the much-discussed Kendrick bill for financial aid to settlers on new reclamation projects failed of passage, but after extended controversy the Interior Department appropriation bill passed and was signed by the President.

Failure of the Kendrick bill is regarded as one of the consequences of the antagonisms aroused by the effort of Representative Cramton, well supported in the House, to attach state-aid conditions to certain of the projects in the Interior bill. The Kendrick bill very generally was regarded as being entirely sound. The Cramton effort singled out certain projects to which the requirements were applied, while other projects in the same bill carried no such conditions.

The Kendrick bill provides for revolutionary changes in reclamation policy. Its adoption would mean that the states would have to assume important responsibilities and make large contributions in money for every new development. The significant fact, brought out repeatedly by Dr. Mead, remains that none of these projects where the construction cost is over $100 an acre are feasible without aid to settlers from some source or other which will enable them to improve their farms.

The controversy over the requirements carried by the Interior Department appropriation bill raged until the final days of the session. Only a Philadelphia lawyer could keep up with the compromises, the proposed compromises and the alterations which were being made. The bill which the President signed attached requirements to four new projects, Kittitas in Washington; Vale in Oregon; Sun River in Montana, and Spanish Springs in Nevada. The state-aid conditions apply to only $375,000 of the Kittitas appropriation; another $375,000 in the form of a reappropriation is not subject to the reservations. This raises a new difficulty for the Bureau of Reclamation to iron out.

The Interior bill carried appropriations for other reclamation work as follows: Yuma project, $432,000, plus $250,000 reappropriated; Grand Valley project $278,000; Uncompahgre project $163,000; Boise project $439,000; Minidoka project $797,000; Huntley project $118,000; Sun River $611,000; Lower Yellowstone project, $180,000; North Platte project, $510,000; Newlands project $167,000; Truckee-Carson project $245,000; Spanish Springs $500,000; Rio Grande project $650,000; Owyhee project $315,000; Umatalla project $840,000; Vale project $700,000; Klamath project $561,000; Salt Lake Basin project $900,000; Yakima project $295,000; Riverton project $790,000; Shoshone project $414,000. In addition there were various minor appropriations which brought the total of the withdrawals authorized from the reclamation fund to approximately $10,000,000.

Engineering Fifty Years Ago

From *Engineering News*, March, 1875

OUR journal was started in "hard times" and has been promptly issued each month, notwithstanding the continued depressed financial condition of the engineering profession and the lines of business that look to it for support, and now that the season for active engineering operations is at hand, we are making our arrangements for more fully carrying out the programme to which we pledged ourselves in our January issue. We claim that our journal now gives more of strictly professional information on the subjects in which engineers and surveyors are interested, than all the other journals of this country together.

We wish it always to be kept in mind that personally we are interested in the prosperity of the profession, and that our income is entirely derived from our labors in field and office. We are always ready to shoulder our transit, or to drag our chain, when our services are solicited, and we are equally, if not more so, interested in learning "something new," or old either, in practice, with every engineer and surveyor in the Union.

L. A. Boulay Refuses to Resign at Ohio Governor's Request

A controversy between Governor Vic Donahey and Ohio Highway Commissioner L. A. Boulay developed last week which resulted in the demand on the part of the governor for the resignation of Commissioner Boulay. This was refused and the highway commissioner will continue to head the department until Aug. 11 when his year's term expires. The mixup came about over a paving contract in Butler County in which the highway commissioner specified Kentucky rock asphalt and the governor desired concrete to be used. Neither would yield in the matter and it resulted in the demand for Mr. Boulay's resignation and his refusal to resign. Since the office is constitutional there is no way for the governor to have the office declared vacant unless Mr. Boulay will step down.

License Issued for 750,000-Hp. Columbia River Project

A license covering the Priest Rapids project of the Washington Irrigation & Development Co. was authorized by the Federal Power Commission on March 2. It covers a 750,000-hp. development on the Columbia River in Washington; the initial installation is to be 340,000 hp. The dam will be 2½ miles long and will consist of earth-fill dikes at each end, a concrete spillway section, a concrete gravity section having fishways, a power house, and a lock entrance to provide for possible future navigation facilities. The storage capacity of the pool will be 85,000 acre-feet.

Before making final plans for the approval of the commission the company shall make a detailed investigation to determine (a) practical method of preventing excessive leaking through the foundations of the dam, (b) the most economical amount of excavation required for the passage of tailwater, and (c) whether the proposed location of the dam is at the best available site.

The licensee is required to provide without expense to the United States the facilities for the construction of navigation locks, a fishway, fish hatchery or other structures as may be determined by the Secretary of Commerce.

The license is issued subject to any rights to the use of water of the Columbia River for irrigation purposes and shall not be construed as granting rights on which to base any claim for damages because of diminution of water supply by the use by others of said waters for irrigation.

Power Line 65 Miles Long May Link Niagara to Staten Island

The Public Service Commission of New Jersey has approved the incorporation of the New York-New Jersey Super-Power Connecting Corp. The company plans to build a high-tension transmission line 65 miles long, to connect the high-tension transmission system in the Mohawk Valley, reaching from Niagara Falls to the power plants in the Adirondacks, with the high-tension transmission lines on Staten Island and in New Jersey.

Canadian National to Build Line to Quebec Gold Fields

Sir Henry Thornton, president of the Canadian National Railway, after a conference with the premier of Quebec, has announced that the Canadian National will build a new line from near O'Brien on the former National Transcontinental Ry. to the Rouyn gold fields, a distance of about 40 miles and at an estimated cost of approximately $1,500,000. Work will be begun without delay.

U. S. and California Give $30,000 for Sacramento Salinity Survey

An additional expenditure of $30,000 to continue the investigation to shut off the flow of salt water, due to tidal action, up the Lower Sacramento River in California through a co-operative agreement between the state of California and the federal government was announced at the Interior Department March 3. According to a contract signed by the Secretary of the Interior and the California Department of Engineering and Irrigation, the state will contribute $15,000 to continue the investigation, while the Bureau of Reclamation will put up a similar amount.

This investigation is to determine whether it is feasible to shut off the extension of salt water up the Sacramento and San Joaquin Rivers through a dam located at Carquinez Straits. Injury from this cause has been augmented by the use of these two rivers in irrigation, and has already caused millions of dollars of damage and threatens the stability of irrigation development of both streams.

It has been shown that satisfactory foundations for such a dam can be secured. The investigators are to make the survey, prepare the plans and estimates for navigation locks. If regulation by this means is not feasible, litigation to restrict the use of water in irrigation on both rivers, now temporarily suspended, will be resumed by irrigators and property owners in the delta of these two rivers. On the other hand, if such regulation is feasible, it will permit of practically the complete use in irrigation of the water of both streams, and a lessening of the uncertainty as to what can be done in the dry season.

Up to this time approximately $50,000 has been expended on the investigation.

63-Mile Railroad Planned by Nickel Plate in Ohio

The New York, Chicago & St. Louis Railroad Co. has applied to the Interstate Commerce Commission for authority to build a new line of railroad from Valley Crossing to Gregg, Ohio, as part of the Chesapeake & Ohio R.R. The line is to consist of 63 miles of double track.

The reason given for the need of the new line is that in connection with the development of the coal lands of West Virginia and Kentucky 70 per cent of the C. & O. tonnage moves to connecting lines and of that 70 per cent 90 per cent moves West over lines of the C. & O. to Waverly, Ohio, the N. & W. to Valley Crossing, and the Hocking Valley to connecting lines at Columbus, Marion, and Toledo, Ohio. The C. & O. controls the Hocking Valley, but neither of these lines has a railroad between Waverly and Valley Crossing, the C. & O. using the tracks of the N. & W. at a restricted car supply and heavy expenditure.

An interesting feature of the application is that it contains as exhibits the proposal of the stockholders of the Nickel Plate, the Chesapeake & Ohio, Hocking Valley, Erie, and Pere Marquette for the organization of a new company to acquire control of the railroads and properties above mentioned for a period of 999 years subject to their funded and other debts and liabilities, and or by acquisition of at least a majority of all their outstanding capital stock or otherwise.

The estimated cost of the new work is $10,000,000 and it is expected that construction will start immediately the application is approved and will be completed within two years.

Port District for Upper Hudson

Under the provisions of a bill now before both houses of the New York State Legislature, an Upper Hudson Port District is created to take advantage of an act of Congress providing for the deepening of the Hudson River to Albany. The port district is fashioned along the same lines as the Port of New York Authority. The territory included in the district takes in the cities of Albany, Schenectady, Troy, Cohoes, Watervliet, Rensselaer, and Mechanicsville. A commission of nine members is to be selected by the cities and towns included in the district. Real property necessary for the port development is to be acquired by purchase or condemnation.

The commission will have authority to borrow money on certificates of indebtedness for expenses and salaries, to prorate the amount among the cities and towns of the district and when plans have been completed and approved for the project to issue bonds and sell them to provide funds for the improvement. The district is made a body corporate and its bonds are not to be backed by the credit of the state.

Oswego, N. Y., Plans Development of Power at High Dam

The city of Oswego, through its Water Service Commission, is canvassing the possible uses for the water power which it owns at dam No. 6, the so-called High Dam, of the Oswego branch of the New York State Barge Canal. This dam is located on the Oswego River at the upper end of the city and creates a head of about 20 ft. The drainage area is about 5,000 sq. miles.

After extended legal proceedings, title of the city to one-half of the water power at this site has been clearly established and recognized through a quit-claim deed from the State of New York.

The Water Service Commission, which is in charge of the matter for the city, includes in its membership two engineers, Charles W. Lindsley, and Homan F. Hallock. The commission has been advised by Frank M. Williams, consulting engineer of Albany, New York, formerly state engineer. Recently the commission has in addition called in F. W. Scheidenhelm of Mead & Scheidenhelm, consulting engineers, New York City, to advise what utilization or disposition of the power should be made by the city. It is reported that the commission will welcome inquiries from prospective users of the power which is to be developed at this site.

Export of Power From Canada Discussed by Engineers

The question of the export of hydroelectric power from Canada was discussed at length at a recent meeting held under the auspices of the Montreal Branch of the Engineering Institute of Canada. Stating the case for export, F. W. Cowie, consulting engineer of the Montreal Harbor Commission, pictured a possible new development of 1,500,000 hp. in the Montreal district, which, including the St. Maurice Valley pulp mills, is now using less than 1,250,000 hp. Valuable as such a development would be to Canada, it cannot be undertaken for 30 years and possibly 50 years, he said, if the Canadian market alone is to be available. With export it would be a practical proposition of the immediate future. If the possible development was proceeded with, Mr. Cowie said, New England in 1925 would doubtless be able to take 750,000 hp., costing $14 at the point of production and distributed to factories across the border for a total of $20. New England needs cheap and abundant power to enable her to maintain her industrial strength against the increasing competition of the southern states. Is not a prosperous New England of more importance to Canada than an exodus of industries to Georgia and Tennessee, which have cheap power and labor and already claim they will capture the position now held by New England, Mr. Cowie asked.

The chief engineer of the Montreal water-works, C. J. Des Balliets, contended in opposition to Mr. Cowie's arguments that, while Canada might now have a surplus of power, she would be able to utilize all her resources in the future and that any exportation of power would strengthen American industry and weaken Canadian industry in the future competition for world markets.

Royal Lesage, consulting engineer, Montreal, said the question was being befogged by all sorts of statements, some actuated by an honest desire to arrive at a right policy but many with the purpose of preventing the financing of possible competitors such as the National Hydro-Electric Co., with its project at Carillon Falls, on the Ottawa. He said that Canada has available water power resources of about 40,000,000 hp. but that the present rate of growth of the population and assuming a 100 per cent increase in the per capita consumption, the country would be able to use only 8,000,000 hp. in 1950.

Canada Approves of Power Project on St. John River

The Canadian government has approved the application of the New Brunswick Hydro-Electric Commission for authority to construct a power project on the St. John River on the international boundary, including the construction of a dam above Grand Falls. The approval of the International Waterways Commission and presumably of the state of Maine and the United States Federal Power Commission will be necessary before construction can be started.

Congress Adjourns Without Acting on Muscle Shoals

Washington Correspondence

Congress adjourned March 4 without having taken definite action on Muscle Shoals. A resolution adopted by the House of Representatives, but not brought forward in the Senate, states that it is the sense of that body that the President should create a commission of three members to report on the "best, cheapest and most available means for the production of nitrate" at Muscle Shoals. It also was resolved "that it is the sense of the House that the value of the nitrate plants to agriculture depends upon the supply of cheap water power from the Wilson Dam and that as a protection to the farmers this power should not be disposed of for other purposes until Congress shall have taken action upon the recommendations of the President."

A resolution of this character has no legal weight and probably will not influence the President since the National Defense Act directs the sale, wherever possible, of surplus property and products. In view of the mandatory language of that statute it is not expected that the Secretary of War will allow the power to go to waste while Congress is making up its mind as to the final disposition of the property.

The effort to cause the government to forego the revenues which can be obtained by the sale of the power, pending action by Congress, is thought to have been inspired by certain local interests who have their own preconceived ideas as to the proper disposition of the properties and the power output.

It is expected that negotiations for the temporary use of the power will be begun soon between the Secretary of War and the representatives of the Alabama Power Co.

Prof. J. F. Hayford, Scientist, Dies

Within a few days after the announcement that his accurate measurement of the equatorial and polar diameters of the earth had been accepted by the International Geodetic and Physical Union, Professor J. F. Hayford, director of the College of Engineering, Northwestern University, died at his home in Evanston, Ill., March 10. He had been ill since December. The decision of the international union, which was made at its recent meeting at Madrid, Spain, means that every boundary survey of the earth will hereafter be based on the Hayford figures, and it is a triumph for American science.

Professor Hayford was born in Rouse's Point, N. Y., in 1868, graduated from Cornell University with the degree of civil engineering in 1889, and was at once appointed a computor of the U. S. Coast and Geodetic Survey. His accurate work was recognized in 1924 by the award to him by the Royal Geographic Society of England of the Victoria Medal for investigation of the theory of isostasy in studies made of the figure of the earth and its structure in relation to the law of gravitation, which study was carried on during 1898-1911 while he was inspector of geodetic work and chief of the computing division of the U. S. Coast and Geodetic Survey.

Professor Hayford had been connected with many important boundary surveys in various parts of the Western Hemisphere.

New Standardization Work Is Announced by A.E.S.C.

A sectional committee on standardization of manhole frames and covers is being organized under the direction of the American Engineering Standards Committee, according to an announcement just issued. Utility interests will be among the sponsors for the committee, and the American Society of Civil Engineers has been asked to share in the work as joint sponsor. A large diversity in types and sizes of manhole frames and covers now exists, which it is expected to reduce through the standardization.

Work may shortly be undertaken by the committee on the unification of threads used on valves fitted to compressed gas cylinders. Difficulty has been experienced, especially by the War Department when refilling such cylinders, because of difference in the threaded fittings. Thus, valve outlets for hydrogen cylinders range in size from 0.8125 to 0.904 in., in eight variations. It is proposed also to use right-hand threads for non-inflammable gases and left-hand threads for inflammable gases, a proposal that probably cannot find general acceptance except through standardization as proposed.

Development of standards for tubular steel poles has just been started, under a committee sponsored by the American Electric Railway Association. A number of municipal engineering and utility societies will join in the work. It is stated that at present a single manufacturer makes about 1,500 types of poles, 22 to 40 ft. long, weighing from 170 to 3,000 lb.

Work has been abandoned on the subject of valve standardization. Extensive discussion and investigation of the subject during the past two years developed a large demand for such standardization, but the Manufacturers Standardization Society of the valves and fittings industry opposed the undertaking, and the American Engineering Standards Committee accordingly has postponed its consideration indefinitely. This is in accordance with the policy of the committee to undertake work on a project only upon formal request and after being assured that the industry at large agrees on the desirability of the work.

Hoboken Shore Line to Be Sold to New York Port Authority

Following the favorable action in the House of Representatives upon the bill authorizing the sale of the Hoboken Shore Line R.R. to the Port of New York Authority, the War Department is preparing to turn over the railroad to the Port Authority, taking its bond in payment for the property.

Pennsylvania Constructors to Meet March 13 and 14

The Associated Pennsylvania Constructors will hold their annual convention March 13 and 14 at the Penn-Harris Hotel, Harrisburg, Pa. On the first day reports of committees will be given, and an address by Henry H. Wilson, past president of the association, on "Four and One-Half Years of Organization in Pennsylvania." Addresses the second day will be "Quantity Survey, Uniform Contracts and Proposed Licensing of Constructors," by Col. D. H. Sawyer, secretary, Associated General Contractors, and "Construction by Day Labor vs. Contract Method," by George B. Walbridge, president, Associated General Contractors.

Speakers at the dinner Friday, at which Frank C. Wight, editor of *Engineering News-Record*, will act as toastmaster, include Mr. Walbridge, S. M. Williams, vice-president of the Autocar Co., Governor Pinchot, Samuel S. Lewis and E. E. Beidleman.

Ohio Engineering Society Meets at Columbus

Engineers from all over Ohio met at Columbus, Ohio, on Feb. 5 and 6 for the annual meeting of the Ohio Engineering Society. Because of the numerous measures before the State Legislature which are of special interest to engineers, the meeting was well attended and the discussion of the papers was active. Resolutions were adopted endorsing the proposed gasoline tax and urging legislation providing for the registration of engineers.

The following officers were elected: President, George F. Schlesinger; vice-presidents, John W. Graham and W. C. Fawcett; and secretary-treasurer, Carl L. Van Voorhis.

American Construction Council to Meet May 8 and 9

The spring meeting of the American Construction Council will be held at the Hotel Biltmore, New York City, May 8 and 9. The program includes a meeting the morning of May 8 of the board of governors at which general conditions affecting the industry will be discussed; a conference on better building in the afternoon of May 8; and a national conference on elimination of peaks and depressions in the construction industry on May 9 at 10 a.m.

Vancouver, B. C., Votes $1,250,000 for Water-Works Extensions

An expenditure of $1,250,000 for water-works extensions has been authorized by a vote of over six to one by ratepayers of Vancouver, B. C. The project includes a 1½-mile tunnel and five miles of 36-in. supply main and a linking up of many distribution dead ends in various parts of the city. Completion of the work will give the city 14 water mains crossing the wide stretch of Burrard Inlet, conveying water from the Capilano and Seymour Rivers.

Testing Materials Committees to Meet in Philadelphia

From March 18 to 20 at the Bellevue-Stratford Hotel in Philadelphia, there will be a three-day session for group meetings of the metals committees of the American Society for Testing Materials. Committees on steel, wrought iron, cast iron, heat treatment, corrosion of iron and steel, malleable castings, ferro alloys, copper wire, non-ferrous metals and alloys, corrosion of non-ferrous metals and metallography will all meet during the three days, and a special program of luncheons and dinners has been provided. This holding of group committee meetings in the American Society for Testing Materials has been in force now for a year or two and is quite successful.

Heretofore, only the metals committees have held the meetings, but it is announced that in the three days, March 25 to March 27, the non-metals committees of the society will have meetings also in Philadelphia. These meetings will include those of the committees on slate, refractories, concrete and concrete aggregates, bituminous water-proofing and roofing materials, insulating tape, performance tests of rubber products, valves for fire alarm systems, concrete culvert pipe, coal and coke, reinforced concrete, electrical insulating materials, road and paving materials, drain tile, and thermometers.

On Thursday afternoon, March 26, those who desire will be given an opportunity to inspect the Delaware River Bridge.

Supreme Court Nullifies State Law Regulating Carriers

The Washington State Law prohibiting common carriers for hire from using the highways of that state between fixed terminals or on regular routes without having obtained a certificate of public convenience and necessity from the state has been declared unconstitutional in so far as it applies to interstate carriers by a decision of the United States Supreme Court rendered on March 2. The decision was rendered in the appeal of A. J. Buck, who, under the Washington Highway Act of 1921, applied for a certificate to operate automobile stages over the Pacific Highway, a federal-aid road, in exclusive interstate passenger and express business between Seattle, Wash., and Portland, Ore. He obtained a permit in Oregon, but was refused a certificate in Washington on the ground that the territory over which his buses would operate was adequately served by steam and electric lines and by four connecting bus lines.

The court, in its decision, did not go deeply into the difference between federal-aid highway and one built without the assistance of funds from the United States.

On the same day the Supreme Court reversed the decision of the Maryland Supreme Court in the case of George W. Bush & Sons Co. against the Public Service Corp. of Maryland. Maryland requires a permit for common carriers using its highways with fixed routes and regular schedules. The Bush Co. applied for a permit for exclusive interstate freight carriage, but the permit was refused. The Trial Court and the State Supreme Court held for the Public Service Corp., but the United States Supreme Court reversed the decision on the ground that the attempted administration of the state law was an invasion of the commerce laws of the Federal Constitution. The highways involved were not built or maintained with federal aid.

Canadian Supreme Court Upholds Crows Nest Pass Agreement

The Supreme Court of Canada on Feb. 26 delivered a judgment in the Crows Nest Pass freight rate case, which put the Crows Nest Pass agreement into effect again by finding that the Board of Railway Commissioners had exceeded their authority in setting the agreement aside.

The Crows Nest Pass agreement was made between the Canadian Government and the Canadian Pacific Ry. in 1897, fixing the rates for westbound freight. Owing to the greatly increased cost of transportation, it was set aside during the World War and for some years following, but was restored last July. The railway companies then appealed to the Board of Railway Commissioners to have it set aside. Their appeal was supported by sections of the country favored by the agreement and opposed by sections discriminated against by it. On Oct. 14, 1924, the commission issued an order abrogating the agreement and restoring the higher freight rates. A strong agitation followed and the question of the authority of the board to set aside the agreement was taken to the Supreme Court, the government in the meantime restoring the Crows Nest Pass rates pending the decision.

The decision of the court not only upholds the agreement, but further finds that it applies only to such lines of the Canadian Pacific Ry. as were in existence in 1897. As this in effect discriminates against all points on other lines of the Canadian Pacific, as well as points on the Canadian National in the West, it is expected that the whole Canadian rate situation will now come before Parliament in order that comprehensive legislation may be passed to correct any existing irregularities.

Stevens to Be Awarded John Fritz Medal on March 23

The John Fritz Gold Medal which was awarded in January to John F. Stevens for achievements as a civil engineer, as a builder of railroads, and as administrator of the Chinese Eastern and Siberian Ry., will be presented with suitable ceremony in the auditorium of the Engineering Societies Building at 8:30 p.m., Monday, March 23. The speakers will be Ralph Budd, president of the Great Northern Ry., and Roland S. Morris, formerly Ambassador to Japan. John R. Freeman, member of the John Fritz Board of Award, will be the chairman of the evening.

Progress on Alouette Project in British Columbia

Good progress is being made on the Alouette hydro-electric project of the British Columbia Electric Ry. Co., Vancouver, B. C. The tunnel, which is 12 x 15 ft. in section and 3,550 ft. long, is being driven from the two portals. At the Stave portal the progress is 10 or 11 ft. per day and at the Alouette end the average rate is about 7 ft. per day. This tunnel is to bring water from Alouette Lake, which will have a storage capacity of 170,000 acre-ft. when the 63-ft. dam across the Alouette River is completed.

Work already done at the damsite includes the construction of railway spurs, a suspension bridge across the Alouette River at the dam axis, a 36-in. steel outlet pipe in the river bed and a considerable amount of clearing in the reservoir.

Upon completion of the tunnel, the water from Alouette Lake will be available for use in the generating plant which is supplied with water from Stave Lake. The building of the proposed 11,500-hp. power house on Stave Lake to utilize the 138-ft. drop from the eastern portal of the Alouette Tunnel has been deferred for a year.

Unlawful Discrimination Basis of Illinois Zoning Decision

The Illinois Supreme Court has reversed a decision of a lower court under which the city of Aurora had been sustained in its proposed revocation of a permit for a four-apartment building because the building was so designed that it could be used for a grocery store. The Supreme Court excluded from its ruling all points except the allegation of discrimination "between property owners now using their property for non-conforming uses and those hereafter desiring to use their property in exactly the same manner," declaring the ordinance void in all such cases.

St. Louis Clears the Way for the Construction of Subways

A bill to clear the way for a rapid-transit system in St. Louis has been presented to the Missouri Legislature. It will amend certain state statutes in regard to public utilities by including a declaration "that a rapid-transit system is a street railway and a public utility, and when municipally owned or controlled shall be deemed to be a public work and a local improvement." The powers of the bill are extended to all cities of 75,000 or more inhabitants authorizing them "to establish, construct, and own and to acquire by condemnation, purchase, lease or otherwise, within or without their respective corporate limits, rapid-transit routes, including subways, elevated and surface lines." The cities would be authorized to operate such lines or lease them to private parties. Special taxes may be assessed against benefited property to defray all or part of the cost and the cities may issue 50-year public utility and general bonds for the purpose.

Wisconsin Engineers Hold Annual Meeting

State Society Discusses Proposal to Publish Proceedings Jointly With Other Societies

A proposal to unite with like societies in near-by states for the publication of proceedings met with favor at the seventeenth annual convention of the Wisconsin Engineering Society, held in the auditorium of the College of Engineering of the University of Wisconsin, Feb. 19 to 21. The plan was suggested by President William G. Kirchoffer, of Madison, who proposed a joint publication to appear six or more times a year. The engineering societies of Indiana, Illinois, and Iowa have been approached upon the subject and have manifested an interest in the proposal. At the present time each of these societies publishes one volume of proceedings a year. Under an exchange agreement a member of one society would receive the proceedings of the other societies as well as of his own.

Sponsor License Bill

Notwithstanding previous defeats, the Wisconsin society is sponsoring an engineers' registration bill which has been recommended for passage by the senate committee on state and local affairs. The proposed law is a modification of the existing one that provides for the registration of architects. It will not attempt to regulate the practice of engineering; it will simply "copyright" the term "engineer." The clause covering this points reads: "After July 1, 1925, no person doing business in this state shall use the term 'architect' or 'engineer' as part of his business name or title, or in any way represent himself to be an architect or engineer, without a certificate of registration, as provided in this section." The proponents of the law believe, it is stated, that there will be a decided tendency for employers of engineers to prefer the engineer whose qualifications have been approved by the state. The law is the result of many years of study upon the part of the society.

Alva L. Hillis, city engineer of Marinette, Wis., was elected president for the ensuing year. Other officers are Clarence M. Baker, sanitary engineer of the Wisconsin Board of Health, vice-president; Leonard S. Smith, professor of city planning at the University of Wisconsin, secretary-treasurer; William G. Kirchoffer, consulting engineer of Madison and retiring president, trustee; and Garret E. Heebink, city engineer of Beloit, trustee.

Among the many papers presented was one by C. I. Corp, professor of sanitary engineering, University of Wisconsin, on "Sewage Plant Operation in Wisconsin." Professor Corp stated that, with one exception, at all of the many sewage plants of the state which he had visited during 1924, there was serious failure to function properly. In discussing this paper, William R. Copeland, chief chemist, Milwaukee Sewerage Commission, asked: "Why should not adequate funds be made available for this service as they are now made available for water service by making the householder pay for it? The assessing of charges for sewage service would be as simple as the assessing of charges for water service," he said, "for sewage is nothing more than polluted water. Water is metered as it goes into a house; let sewage be metered as it goes out."

Dredging of N. Y. Barge Canal to Be Undertaken

Following a conference of engineers of various New York State departments, it has been announced that in addition to the work which will be undertaken during the coming season by the dredges of the Department of Canals and Waterways, the department will let 5 contracts calling for the removal of approximately 700,000 cu.yd. of material. Plans will be prepared by the state engineer, and bids will be called for as soon as the Legislature appropriates the necessary money. It is hoped that the work will be ready to start by the time the canal opens.

Standard Contract Forms Soon to Be Distributed

A standard form of contract for suggested use in engineering construction was agreed upon by the Joint Conference on Standard Construction Contracts held in New York Feb. 25. Copies will be issued within a few weeks to the organizations composing the conference and to allied associations.

Owing to the varying conditions necessarily involved in work in the engineering field, it is not expected that the standard contract can be used frequently without changes, but the idea in drafting this document has been to embody certain fundamental principles, based upon the best existing practice and the ideal toward which the professions involved and the contractors are aiming, to be followed as closely as the individual conditions surrounding each contract will permit.

Meeting with representatives of the joint conference at the New York session were legal representatives of the American Arbitration Society and of the Chamber of Commerce of New York State in order to redraft the suggested arbitration clause, the only point which had remained undecided after a previous conference in Washington when the building construction standard contract form was adopted and material progress on the engineering contract was made. As redrafted, the arbitration clause lays down a recommended practice as to arbitration procedure.

It is expected that from time to time organizations interested will propose modifications of the engineering standard contract, the understanding being that the document as it stands now is subject to future revision.

Represented on the joint conference are the American Association of State Highway Officials, American Engineering Council, American Institute of Architects, American Railway Engineering Association, American Society of Civil Engineers, American Water Works Association, Associated General Contractors of America, and Western Society of Engineers.

Random Lines

Day Before Payday

By ELLDEE

'Twas the day before payday, and all of the force were naturally happy and joyous of course; and plied their dividers and T-squares and scales with the speed and dispatch of a covey of snails. For payday meant much 'round the old drafting room and every stool pigeon was making things zoom! One bald-headed rooster kinked over some "notes" had a smile on his lips, while a full bowl of oats ever loomed on his vision to brighten the way till tomorrow should come and he'd pull down his pay. Another—a little dried up piece of cheese with hard-calloused elbows and bean full of fleas, was humming a snatch of a gay lilting song, while he added a string of dimensions up wrong—heart set on a new pair of wearever socks when payday arrived and the checks came in flocks.—The day before payday!—and strange tho it seem, every ink-slinging pelican nursed a fond dream as he sat on his stool with his legs in a knot and dabbled his quill in the old Higgins pot,—of what he would purchase and what he would do when the dawn of another day—payday—came true!

Day After Payday

By ELLDEE

'Twas the day after payday, the old drafting room was as dead as a door nail, a dodo or tomb. The kangaroos shackled to high chair or stool were drearily plying the pencil or rule; for payday was over, the great day was past, and every fond dream, sad to say, had been gassed. And ninety per cent, more or less, of the bunch were shy of the castings to purchase a lunch. And many a frog who had figured in glee on a bob and shampoodle still longed for the fee. But his missus was happy in new beeveedees and the larder was stocked up with pickles and cheese. And Olaf and Rastus and Julia and Nate, and Tebo and Heinie and Ikey and Kate, were sporting new roller skates, rattles and clothes; while dad was still frowsy and out at the toes. The unmarried sunfish, a-yawn and a-gap, with steam-shovel furrows adorning his map was in the same boat, with regard to the beans; for not a shinplaster had he in his jeans! 'Twas the day after payday, the drawers of lines were rocking the welkin with sighs and with whines, as they platted or figured or traced or erased, and prayed that NEXT payday would "Haste hither—haste!"

* * *

Youth Must Be Served

Wanted—Civil engineer, 25-30 years, accurate instrument man, competent to make building surveys within close limits, preferably with five or more years' experience in building construction. Must have minimum of ten years' construction experience. — E. N.-R. Want Ad.

Engineering Societies

Calendar

Annual Meetings

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; Spring Meeting, Cincinnati, April 22-24, 1925.

AMERICAN WATER WORKS ASSOCIATION, New York City; Annual Convention, Louisville, Ky., April 27 to May 2, 1925.

NATIONAL FIRE PROTECTION ASSOCIATION, Boston, Mass.; Annual Convention, Chicago, May 12-14, 1925.

AMERICAN ASSOCIATION OF ENGINEERS, Chicago, Ill.; Annual Convention, Orlando, Fla., June 2-5, 1925.

AMERICAN SOCIETY FOR TESTING MATERIALS, Philadelphia, Pa.; Annual Meeting, Atlantic City, N. J., June 22-26, 1925.

The San Francisco Section of the American Society of Civil Engineers held its regular bi-monthly dinner meeting Tuesday evening, Feb. 17. After an inaugural address by H. C. Vensano, the incoming president, and a short business session, I. C. Steele, chief of division of civil engineering, Pacific Gas and Electric Co., San Francisco, spoke on "Engineering Problems in the Construction of the Pit River No. 3 Hydro-Electric Development." In order to bring out some of the various viewpoints involved in a project of this kind, twelve-minute speeches were made by F. E. Bonner, district engineer, U. S. Forest Service, on "Federal Control over Water Power Development"; Ely C. Hutchinson, vice-president and general manager, Pelton Water Wheel Co., on "High Lights of Water Wheel Design, 1925 Model"; and O. W. Peterson, construction engineer, Pacific Gas and Electric Co., on "Kinks and Tricks in Construction."

Personal Notes

EARLE MAULDIN, civil engineer, Greenville, S. C., associated since 1905 with J. E. Sirrine of that city, has been made vice-president and general manager of W. M. Welch, Inc., general contractors, Greenville.

HARRY C. LEA, for fourteen years superintendent of public works at Aspinwall, Iowa, an office recently abolished, was chosen borough manager of Aspinwall, a position newly created. Mr. Lea's term as superintendent of public works had been interrupted by service in the World War.

L. B. HITCHCOCK, civil engineer, has been appointed city manager of Phoenix, Ariz., and will direct a number of municipal improvements involving engineering problems, one improvement being the diversion of a large irrigation ditch that now cuts through the heart of the city. Mr. Hitchcock was city engineer of Phoenix at the time when the city constructed a new water system and a 33-mile pipe line bringing water from the mountains. With the completion of that work Mr. Hitchcock resigned to become a member of a road contracting firm. He had previously been in the Reclamation Service.

N. J. MCCLURE, recently chief engineer of the Russell N. Edwards Co., Indianapolis, Ind., has severed his connections with the company to go into business for himself, with an office at 404 City Trust Building, Indianapolis.

Obituary

ROBERT H. MCCORMICK, consulting engineer, Detroit, Mich., and city engineer of Detroit from 1898 to 1916, died Feb. 22 at his home in that city after a prolonged illness. He was 72 years of age. Fifty years ago Mr. McCormick entered the city engineering department of Detroit and served there ten years. Subsequently he worked on a government survey of the Mississippi River and on construction of the Wabash and on the Detroit & Mackinaw railroads, then went back to the Detroit work. He was instrumental in the introduction of asphalt paving for Detroit streets, on Cass Ave., first, in 1895, later on Woodward Ave. He also directed a survey of the city sewage problems and supervised the planning and laying out of the sewage system. Mr. McCormick retired in 1916 on account of ill health.

JOHN COOPERSTOCK, a designing engineer with the Board of Transportation, New York City, died March 5, at his home at the age of 54 years. Mr. Cooperstock was a graduate of New York University and had been continuously in the employ of the city since 1888.

ROSWELL J. AYDLOTTE, since 1920 county engineer of Delaware County, Pennsylvania, died Feb. 23 at his home in Chester, aged 33 years; he became ill about two years ago and a spinal infection caused paralysis. Mr. Aydlotte had designed many bridges erected in Delaware County during the past five years; most prominent is the memorial bridge on the Baltimore Pike, spanning Crum Creek, near Media, Pa. He was graduated from Bucknell College. For many years he was connected with the United States Engineering Department on the Delaware River.

HORACE LOOMIS, for more than forty years connected with New York City's engineering department, died March 8 at his home in Mount Vernon, N. Y., in his 85th year. In 1875 Mr. Loomis was appointed assistant engineer on surveys for the Croton aqueduct for supplying water to New York City, but served only a short time on that work. Later he served on park and on paving work, being a pioneer in laying asphalt and concrete pavement foundations. In 1886 he was made chief engineer of the Bureau of Sewers, which until 1902 covered the entire city but after that date was restricted to the Borough of Manhattan. In 1910 he became consulting engineer of the Bureau of Sewers, which position he held until his retirement in 1914. Mr. Loomis graduated from Rensselaer Polytechnic Institute in 1865 and was a charter member of the Engineers' Club of Manhattan.

JAN V. HALAS, civil, hydraulic and electrical engineer, Portland, Ore., was killed in an automobile accident on the streets of Portland, Feb. 24. Mr. Halas was born in Bohemia in 1878, graduated from Prague Technical College in 1900, was professor of mathematics in that school one year, and spent seven years with Austro-Hungarian military engineers. He came to America in 1909 and went to Portland in 1911 as representative of Smith, Berry & Chase, engineers, of Toronto, Canada. He designed the Bull Run dam and pipe line for the Portland water-works, and since that time had been prominent as a civil and hydro-electric engineer on the Pacific Coast.

E. WHEELER CARR, consulting engineer, New Orleans, La., and a specialist in contracting and appraisal work and in heating engineering, died at his home in that city Feb. 21 after an operation, aged 45 years. Born in Brooklyn, N. Y., and an engineering graduate of Cornell University, Mr. Carr's early service was on the Canadian Pacific R.R. and with engineering firms in Chicago. In New Orleans, prior to 1912 he was heating engineer for Ahrens & Ott Manufacturing Co. and later estimator and erection superintendent for the E. A. Sammons Machinery Co. In 1912 he took up consulting practice.

JOHN PINDER, a well-known civil engineer of Montreal, died March 4 after a long illness, in his 57th year. He was born in England and after practicing for some years in the United States went to Montreal about eight years ago where he was connected with various engineering undertakings.

WILBUR F. GOODRICH, a civil engineer of prominence for 40 years, died Feb. 24 at a hospital in Boston. Mr. Goodrich was born in Lunenburg, Mass., 71 years ago, and was a graduate of Massachusetts Agricultural College. He obtained public prominence as an engineer engaged on erection of the Boston South Station. He was civil engineer with the Boston & Maine R.R. for a number of years, and superintended many projects.

MAJOR FRANCIS LOWELL HILLS, widely known engineer, died recently at his home in Marblehead, Mass. He was born in Boston in 1844 and entered West Point in 1866, graduating in 1871. Mr. Hills was superintendent of maintenance-of-way with the New England R.R. from 1881 to 1884. From 1888 until 1889 he was director of public works in Porto Rico. Mr. Hills was offered the post of imperial chief engineer of the Chinese railroad system in 1892. He was associated with the United States Engineers' office, sixth lighthouse district, for a number of years, and at one time was professor at the University of Maine.

From the Manufacturer's Point of View

A Point of Contact Between Maker and User of Construction Equipment and Materials

General Electric Co. Investigation By Trade Commission Begun

Washington Correspondence

The Federal Trade Commission is losing no time in beginning the investigation of the General Electric Co. which has been ordered by the United States Senate. When the resolution was delivered to the commission on Feb. 12, a meeting of the members was called and it was decided to refer the resolution to the Commission's economic division, since the work was regarded as likely to be more of a statistical and accounting character rather than of a legal nature. The commission called in its chief examiners. Schedules were arranged looking to the completion of the investigation in ample time for the commission to have its report ready for submission to Congress Dec. 1.

Some of those who see in this probe an effort to boost public ownership are hoping that the commission's investigation may go far enough to show who were furnishing the evidence presented to support the resolution. There is a rumor to the effect that a public ownership group had effective co-operation from a competing concern.

Unfilled Orders Increase for Paving Brick

With the figures for production and unfilled orders at hand for the month of January, the vitrified paving brick industry is looking forward in 1925 to what may be, according to a report just made to the U. S. Department of Commerce by the National Paving Brick Manufacturers' Association, a record-breaking year in street and highway paving. Shutdowns during January for inventory and repairs were for the most part of minimum duration and throughout the industry generally manufacturers are working at more than 60 per cent capacity in what is always considered on off-season, building up a large stock-on-hand to take care of the spring, summer and fall orders.

The distribution of unfilled orders throughout the country shows that there is nothing sectional as regards contemplated paving programs. Ohio leads the list with unfilled orders already on hand for 13,036,000 brick. Texas is second with 9,000,000, Florida third with 3,201,000 and Illinois fourth with 3,130,000.

With 31 companies reporting for January as against 24 companies for December, production had jumped from 23,000,000 to 25,266,000. Stock on hand stood at 111,666,000 on Jan. 31 and unfilled orders had increased from 44,059,000 to 51,572,000. The 31 companies reporting represent 69 per cent of the total tonnage capacity of the industry and reported activity at 62 per cent of the normal monthly capacity.

Special Train for Water-Works Convention at Louisville

A special train over the Pennsylvania R.R. will carry delegates from New York and other Eastern cities to the annual convention of the American Water Works Association, to be held in Louisville, Ky., April 27-May 2. The train will leave the Pennsylvania Station, New York, at 10:05 a.m. (Eastern Standard time) Sunday, April 26, and will arrive in Louisville at 10:30 a.m. Monday, April 27. The route will be via North Philadelphia, Harrisburg, Altoona, Johnstown, Pittsburgh, Cincinnati. A rate of fare and one-half for the round trip has been authorized for those who secure certificates at the time of purchasing their tickets. Requests for reservation on the special train should be addressed to the chairman of the association's Transportation Committee, Walter H. Van Winkle, Room 1951, 50 Church St., New York, N. Y.

Concrete Road Yardage

During January, 1925, awards of contracts for concrete pavement in the United States totaled 4,512,913 sq.yd., according to figures compiled by the Portland Cement Association. Of this amount, 3,474,421 sq.yd. were for roads; 963,256 sq.yd. for streets; and 75,236, sq.yd. for alleys.

For the year 1924 the total concrete road and pavement yardage completed in the United States was 99,040,427 sq.yd., and for the year 1923 the total was 79,569,387 sq.yd.

Lumber Men to Meet

Among the subjects occupying places on the program for the tenth annual meeting of the Southern Pine Association, to be held in New Orleans, March 24 and 25, will be grade marking of Southern pine lumber for protection of the public against fraud; reforestation and timber conservation; standardization of lumber sizes and grades; traffic and transportation; and economics.

Ford Sales for January

During January there were sold 4,156 Fordson tractors and 103,022 Ford cars and trucks. Of these, domestic retail deliveries for January were 76,062 cars, 13,790 trucks, and 3,384 tractors.

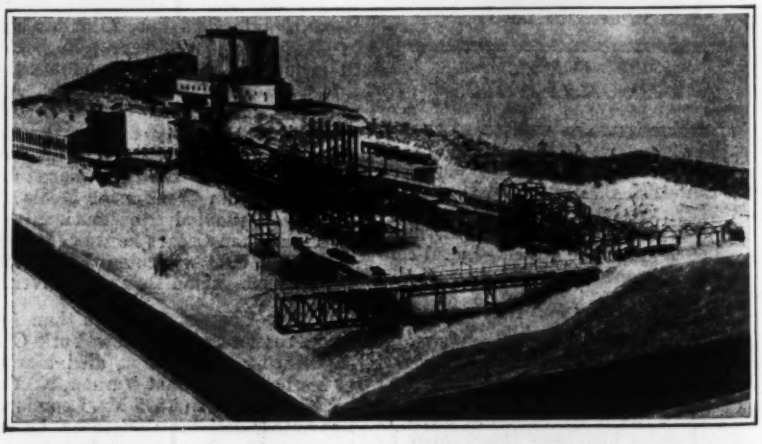
Report Indicates Growing Field for Diesel Engine

Worthington Pump & Machinery Corporation, New York, in its annual report for the year 1924, announces billings to customers of $16,572,066 and profits from manufacturing and trading of $1,067,195. After crediting other income and deducting interest on notes, the net income from operations during the year was $1,347,779. Dividends paid during the year on preferred stock totaled $1,010,798. In a statement to stockholders C. Philip Coleman, president, said in part:

"The development and engineering research work necessary to the broadening of the corporation's market have shown increasingly substantial results. Sales of Unaflow, air and ammonia compressors, motor-driven compressors with step control, and the Axiflo and Coniflo types of deep-well pumps have all shown healthy growth. Work is proceeding on extensions and improvements of the centrifugal pump line, which should augment sales.

"The 4-cycle, air-injunction vertical

Field Museum Records Modern Cement Making



A model of a modern portland cement plant, so complete in detail that it took two artisans three years to build it, has just been completed by the Field Museum, Chicago, and placed on display. The model was built by Dr. W. H. Nichols and Valerie Legault. The model is a reproduction of the Marquette Cement Co.'s plant at La Salle, Ill., and is 12 ft. long by 4 ft. wide.

Incidentally, the model is of such strong construction that museum officials are quoted as predicting that it will last indefinitely. At the end of 100 years it will be contrasted with another model showing the manufacture of cement or similar commodity.

Diesel engine has justified itself both in performance and in profit, and there is distinctly increasing demand for Diesel oil engines in all of the several types manufactured by the corporation. During the year the first unit of the Worthington double-acting two-cycle engine was built and demonstrated. The performance was satisfactory. The engine is offered in cylinder sizes from 250 to 2,000 hp. and in multiple-cylinder combinations from 750 to 12,000 hp. per engine.

"In line with a policy of concentrating production and disposing of some lines of product, the Hazleton and Epping-Carpenter works were sold; the gas-engine works and the power and mining works, both located at Cudahy, Wis., were closed and the inventory and business of the mining, crushing and cement machinery of the power and mining works were sold. The possibility of a further consolidation of manufacturing facilities is being surveyed."

Patent Issued for Improved Flake Calcium Chloride

U. S. Patent No. 1,527,121, dated Feb. 17, 1925, has been issued to the Dow Chemical Co., Midland, Mich., covering a process of manufacturing metallic chloride products and products made by the new process. The patent broadly covers the improved form of calcium chloride which the company has marketed for a number of years and which has found an extensive use among highway officials and contractors for dust prevention on gravel and stone roads and for curing concrete. The main property of the product is the absorption and retention of a volume of moisture sufficient to cure concrete without earth or straw covering or ponding, and without need for pipe lines and water pumping. The same moisture-absorbing property aids the maintenance of gravel and stone road surfaces in a firm, moist and dustless condition.

The calcium chloride covered by the new patent is a non-caking flake which the new process renders suitable for packing in bags and for shipping and storing in that form without caking, since it is superficially dehydrated to the point where the tendency to cake in the package is reduced. The flakelike particles are superficially dried and a portion of the water of crystallization is also removed.

Court Denies Review of Rock Crusher Patent Case

The United States Supreme Court on March 9 refused to grant a writ of certiorari sought by the Traylor Engineering & Manufacturing Co., South Allentown, Pa., to appeal from a decision of the Third Circuit Court of Appeals in favor of the Worthington Pump & Machinery Corporation, New York. The case involved alleged infringement of a patent for improvements on a gyratory rock crusher. The Traylor company alleged the decision involved fundamental principles of patent law and was at variance with the construction of two other courts of circuit appeal, but the Supreme Court took a contrary view.

Business Notes

AMERICAN VIBROLITHIC CORPORATION, Des Moines, Iowa, announces the recent opening of sales offices in San Jose and Los Angeles, Calif., under the official corporate name of the California Vibrolithic Co.

DURIRON CO., INC., Dayton, Ohio, manufacturer of acid proof pipe and exhaust fans, has recently appointed the following representatives: Walter Drew, New York City, for eastern New York State; J. M. McKee, Boston, for Maine, New Hampshire, Rhode Island and eastern Massachusetts; E. H. Platz, Jr., Philadelphia, for Maryland, New Jersey, Delaware and eastern Pennsylvania. All representatives are available for consultation regarding the proper layout of drainage or ventilation systems involving corrosive liquids or gases.

FOUNDATION CO., New York, general contractor, in its annual report for 1924, shows a gross income of $1,997,842 compared with $1,358,469 in 1923; and net income, after taxes and expenses, of $996,300 for 1924 as against $493,298 the previous year.

BYERS MACHINE CO., Ravenna, Ohio, held a company convention at the Congress Hotel, Chicago, Jan. 4 and 5 in connection with the road show. This convention was attended by seventy representatives from the Byers sales offices and agencies in various parts of the country.

CHICAGO PNEUMATIC TOOL CO. has recently opened a branch office in Mexico City. The address is 1ª San Juan De Letran, 15 Mexico, D. F.

MCMYLER-INTERSTATE CO., Cleveland, Ohio, has appointed the Lewis-Patten Co., San Antonio, Texas, as agent for the sale of its gasoline and steam shovels, clamshell buckets and locomotive cranes in the entire state of Texas.

T. L. SMITH CO., Milwaukee, Wis., has appointed Hubbard-Floyd Co., 452 Lexington Ave., New York City, as representatives in the New York territory for the sale of its concrete mixers.

HYATT ROLLER BEARING CO., Harrison, N. J., has recently appointed P. C. Gunion, for six years advertising manager, to a place on the company's sales board which is now composed of the general manager of sales and his assistant, the advertising and research manager and the three sales managers in charge of the automotive, farm machinery and industrial divisions. In addition to his advertising work Mr. Gunion will head up market research activities.

NORTHWEST ENGINEERING CO., Chicago, Ill., builder of gasoline and electric cranes, shovels and draglines, announces the appointment of two new agents. The Wilson Machinery Co., 1526 16th St., Denver, will handle the sale of Northwest equipment in Colorado and the Toledo territory will be in the hands of J. R. Van Koppel, 209 Williams St., Toledo, Ohio.

HARNISCHFEGER CORPORATION (formerly Pawling & Harnischfeger Co.) Milwaukee, Wis., announces the appointment of A. A. Boschert as sales engineer, for Washington and Oregon, with offices in the L. C. Smith Building, Seattle, Wash.

AMERICAN RADIATOR CO., New York, has announced the appointment of the following new officers: C. K. Foster, vice-president and treasurer in charge of western executive offices, to be executive vice-president; Wetmore Hodges, secretary, to be vice-president and secretary, director of advertising; R. B. Flershem, general manager of sales, to be vice-president in charge of sales; Stanley B. DeLong, general manager of manufacture, to be vice-president in charge of manufacture; A. E. Swanson, assistant to the president, to be vice-president and assistant to the president; Andre Mertzanoff to be vice-president, in charge of planning and research.

Equipment and Materials

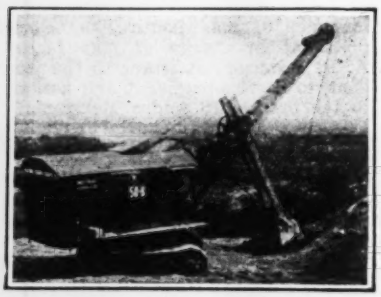
Screw Turbine Pump for Handling Activated Sewage Sludge

For handling activated sludge at sewage treatment plants, the Frank J. Kimball Co., Los Angeles, has developed a direct-flow electrically-driven turbine pump employing low velocities designed to avoid the breaking up of the floc of the sludge. With this end in view, the impellers have been made of the screw turbine type, of polished brass, one on each side of a bronze bearing located in the column section. In the column section also are diffusion vanes to correct and control the flow of the sludge, the velocities throughout the entire pump and column being much lower than are usually allowed for pumping other liquids.

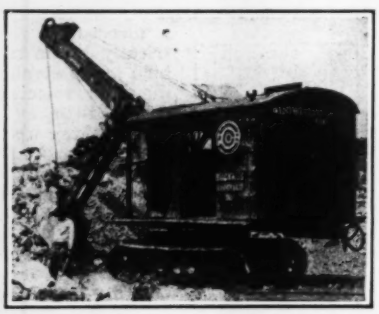
The drive is by a vertical electric motor direct connected to the pump shaft by either a compression or a flexible coupling. A stuffing box is located at the point where the pump shaft passes through the base of the motor frame, the latter acting as a blank flange for the top of the tee. Lubrication for both the bearing below the stuffing box and the bronze bearing in the column section is effected through copper tubes, terminating in Alemite force feed fittings in the upper flange of the tee. The pumping unit shown in the accompanying photograph is arranged for use in connection with a riser and is built in sizes ranging from 250,000 to 5,000,000 gal. daily.

Demand Grows for Electric, Gas and Diesel Power Shovels

One of the most striking developments within the past year in the field of excavating machinery, according to the experience of the Bucyrus Co., South Milwaukee, Wis., manufacturer of power shovels and draglines, has been the marked increase in the demand by contractors and engineers for equipment powered with electric motors or internal combustion engines. The demand for electric machinery, the company states, comes for the most part from operators whose work is more or less stationary — quarries, mines and large construction undertakings. The rapid extension of power lines has widened the application of electricity to construction equipment



Standard Types of Shovel Powered with Electric Motors (Top) and Diesel Engine (Bottom)



and with this expansion of electric service has come a greater confidence in and a greater knowledge of electrical machinery on the part of the user. Manufacturers have responded to this demand, and most of them now are prepared to offer a complete line of electrically-operated shovels, draglines and dredges, from the ¾-yd. road builder's shovel to the giant stripping shovel with an 8-yd. dipper. These machines, their manufacturers believe, have proved themselves equal to steam-driven machines in power and reliability and are even more economical where electric power is available at reasonable rates.

The gasoline shovel is now widely used in the construction field and the shovel and dragline powered with the Diesel engine has recently made its appearance. Advocates of the latter type of power equipment, because of its great economy of operation and the flexible characteristics of its driving unit, predict for it a broadening use in construction service.

Business Side of Construction

FACTS AND EVENTS THAT AFFECT COST AND VOLUME

Current Buying for Replenishment of Materials Reserves Stimulated by Fear of Higher Costs

Danger of Production in Excess of Actual Demand Disappearing With Absence of Rapid Price Advances

There is considerable buying in the current market for replenishment of material stocks but without danger of accumulation of undesirable inventories. Present purchasing is stimulated mainly by fear of higher prices, otherwise it would be confined to immediate requirements, as in the past two years.

The danger of production schedules being set too far in excess of actual demand, fades with the absence of rapidly advancing prices.

Conditions existing in the production of several of the principal materials, follow:

Iron and Steel—The former is being produced at an unprecedented rate for this time of the year, while the latter will probably run at about 75 per cent of mill capacity up to the end of June, 1925. The present steel output is believed to be slightly above the rate of consumption.

Production of steel ingots by all companies in the U. S., as calculated by the American Iron and Steel Institute, reached 3,740,004 tons for the month of February. This shows a drop of 10 per cent from the January total of 4,180,413 tons and 2 per cent from the February, 1924, output of 3,809,185 tons. Monthly production figures follow:

	1924 Tons	1925 Tons
January	3,633,639	4,180,413
February	3,809,185	3,740,004
March	4,187,942*	.....

* Highest point reached in 1924.

Undiminished demand for steel is reflected in the gain in unfilled orders on books of the U. S. Steel Corp., Feb. 28, over those at hand Jan. 31, 1925. February bookings amounted to 5,284,771 tons, against 5,037,323 tons in January and 4,912,901 tons for February, last year. This is the largest unfilled tonnage report issued since August, 1924.

Lumber—Current demand and shipments on old orders are increasing from week to week; the volume is also greater than a year ago. Mill output, while it is advancing steadily, is still considerably below the production rate for the corresponding period in 1924.

According to the National Lumber Manufacturers Association, the following table compares the national lumber movement for the three weeks indicated:

	Week of Feb. 28, 1925 Ft. b.m.	Corresponding Week In 1924 Ft. b.m.	Preceding Week in 1925 Ft. b.m.
Mills	352	386	366
Production	227,802,224	241,350,597	217,024,120
Shipments	241,350,597	236,535,294	218,343,104
New Orders	217,024,120	191,508,372	208,600,531

The following tabulation compares the lumber movements for the first nine weeks of 1925 with the same period of 1924:

	Production Ft. b.m.	Shipments Ft. b.m.	Orders Ft. b.m.
1925	1,939,646,655	1,964,056,737	1,864,259,976
1924	1,973,117,481	2,077,074,974	2,095,767,639
1925 Decrease	33,470,826	113,018,237	231,507,663

During the first eight weeks of the current year total production for the nation amounted to 1,711,844,431 ft.; in the corresponding period of 1924, there were 1,719,928,211 ft. produced; in the same weeks of 1923, the output reached 1,580,852,455 ft. From present indications it appears as though 1925 will fall below last year in lumber output. If this does prove to be the case, it must be remembered that it is evidently well above 1923. That year was a $6,000,000,000 construction year; $4,500,000,000 in buildings alone and at least $1,500,000,000 in such classifications as water-works, sewers, excavations, paving, bridges, and other public work.

Cement—The fact that contract letting, Jan. 1 to date, for large engineering construction projects, is over one per cent ahead of the corresponding period last year, would justify the belief that cement output and demand will at least be as heavy as during 1924.

Cement output and demand, according to the Geological Survey, follows:

	Production Bbl.		Shipments Bbl.	
	1924	1925	1924	1925
Jan.	8,788,000	8,916,000	5,210,000	5,108,000
Feb.	8,588,000	8,716,000*	5,933,000	5,831,000*
Mar.	10,370,000	10,498,000*	8,995,000	8,893,003*
First Qrtr.	27,746,000	28,130,000*	20,138,000	19,832,000*

*Estimated.

Brick—Latest available reports from brick manufacturers throughout the country, show that conditions as of Feb. 1, reflected a decline in brick movements compared with those existing Jan. 1, 1925. Before the current month is out, movements from yards will probably show a heavier volume than a year ago. The following tabulation is compiled from reports of the Common Brick Manufacturers' Association of America:

1924	Burned Brick on Hand M.	Unburned Brick on Hand M.	Brick Moved from Yards During Month M.	Orders on Books M.
Jan. 1	313,696	55,646	66,199	266,914
Feb. 1	306,503	38,349	45,762	272,403
March 1	282,813	39,695	104,663	263,219
April 1	250,118	46,226	142,197	335,926
May 1	238,703	58,972	169,855	382,778
June 1	223,458	70,802	163,298	394,156
1925				
Jan. 1	354,477	51,162	118,759	202,906
Feb. 1	279,862	23,951	94,185	201,479

Belgium Heaviest Exporter of Brick To U. S.

Over 44 Millions Have Entered Port of New York from Eight Foreign Nations Since Jan. 1, 1924

With the beginning of the regular spring demand for building materials not a month off, the interest of the New York construction market again centers on brick.

The Bureau of Foreign and Domestic Commerce reports imports of building brick into the customs district of New York, during the calendar year 1923, amounting to 61,506,000; the 1924 total was 44,208,000.

IMPORTS OF COMMON BRICK INTO CUSTOMS DISTRICT OF NEW YORK DURING 1924

January	Germany	803,000
	Holland	1,000
February	Belgium	2,603,000
	Germany	187,000
March	Belgium	2,338,000
	Germany	9,284,000
	England	2,000
	Belgium	1,612,000
April	Germany	2,045,000
	England	20,000
	Belgium	2,471,000
May	Holland	2,700,000
	England	20,000
	Belgium	1,985,000
June	Germany	500,000
	Italy	59,000
	England	3,000
	Belgium	2,504,000
July	Italy	242,000
	Holland	110,000
	Canada	781,000
	Belgium	4,450,000
August	Germany	445,000
	Italy	279,000
	Holland	1,692,000
	Belgium	1,236,000
September	Germany	809,000
	Holland	330,000
	Canada	376,000
	Belgium	100,000
October	Germany	3 101,000
	Holland	11,000
	England	3,000
	Canada	115,000
	Belgium	737,000
	Italy	1,000
November	Holland	1,625,000
	Spain	5,000
	Canada	93,000
	Mexico	10,000
December	Belgium	464,000
	Holland	15,000
	Canada	33,000
	Mexico	8,000
Total		44,208,000

This decrease in the influx of foreign brick indicates that two important factors have been at work during the past year. One, is the greatly increased production on the part of American manufacturers and the other, a decrease in demand.

With a recently threatened strike of iron workers, derrickmen and riggers in this city, demand is apt to shrink still further.

In an effort to determine just how far these forty-four millions have penetrated the American market, *Engineering News-Record* has communicated with several of the principal manufacturers and dealers located along the Atlantic seaboard.

As evidence of the fact that most if not all of the imported material was absorbed by the Metropolitan district, excerpts from some of the letters follow:

Edward J. Smith, brick manufacturer of Albany, N. Y., states, regarding the European shipments, that "none of them reached our market but had a tendency to reduce our prices here, as some large manufacturers within a radius of 20-mi. of Albany, who had been shipping most of their products to New York, turned their attention to the Albany market, consequently lowering prices." Mr. Smith is of the opinion that brick manufacturers supplying the Greater New York market, should make an effort to have protective tariff measures passed.

Claude Roper, sales manager for the Gamble & Stockton Co., Jacksonville, Fla., states that "there was a report some time ago that a cargo of foreign brick was to be brought into the port of Tampa, Fla., but as far as we are advised, it was never actually received at that port. With the above possible exception, we believe there has been no foreign made brick used in this state."

C. W. McDowell, representing L. L. Stephenson, brick manufacturer of Birmingham, Ala., states that his firm "does not know of any point in the South or Southeast where any foreign brick have been used, and we think it is hardly probable that there will be any used in this district for the reason that prices on common brick throughout this section are very reasonable and would not justify shipments from any foreign country."

The eight countries making the shipments to the United States and the quantities received from each, follow:

Belgium	18,500,000
Germany	17,174,000
Holland	6,484,000
Canada	1,398,000
Italy	581,000
England	48,000
Mexico	18,000
Spain	5,000
Total	44,208,000

The first three started shipping early in the year; England began in March; Italy, in June; Canada, in July and Spain and Mexico sent their initial consignments in November, 1924. The average price of these bricks, at New York dock, was $6.79 per M.

Unit Bids Compared on N. Y.-N. J. Vehicular Tunnel

Following are bids opened by New York State Bridge & Tunnel Comn., and New Jersey Interstate Bridge & Tunnel Comn., Woolworth Bldg., New York City, for constructing two open approaches of the vehicular tunnel under the Hudson River, New York City. Contr. No. 5-A, (A) Rodgers & Hagerty, Inc. (awarded contract); (B) Moranti & Raymond, Inc.; (C) Frederick L. Cranford, Inc. The unit bids are as follows:

	A	B	C
14,500 cu.yd excavation above M.H.W.	$6.00	$13.25	$14.60
3,000 cu.yd excavation below M.H.W.	6.00	13.25	14.60
4,400 cu.yd concrete	20.00	23.00	24.15
2,050 sq.ft. pre-cast concrete forms	35	50	50
100 bbl. mortar batches used in connection with placing concrete	5.00	4.50	10.00
30 cu.yd brick masonry	50.00	33.00	40.00
1,400 lin.ft. granite curbing for tunnel roadway	4.50	4.50	4.00
5 cu.yd. hollow terra cotta tile	45.00	33.00	40.00
1,000 sq.yd. waterproofing, treated fabric laid with asphalt, 2-ply	2.80	1.50	2.00
370 sq.yd. waterproofing, treated fabric laid with asphalt, 3-ply	4.20	2.00	2.75
2,000 sq.yd. waterproofing, treated fabric laid with asphalt, 4-ply	5.60	3.50	3.00
10 sq.yd. waterproofing, treated fabric laid with asphalt, 5-ply	7.00	4.00	4.00
800 sq.yd. waterproofing, treated fabric laid with asphalt, 6-ply	8.40	5.00	4.50
70 cu.yd. waterproofing, brick in asphalt mastic including 1-ply treated fabric	55.00	55.00	50.00
100 ton built up steel work and tie rods	120.00	125.00	130.00
1 ton bolts, castings and wrought-iron fixtures not otherwise provided for	300.00	320.00	400.00
23 ton steel beams and shapes	120.00	125.00	130.00
175 ton steel rods and bars	110.00	90.00	100.00
3 ton wire mesh	200.00	200.00	400.00
1.6 ton copper steel plates, bolts, nuts and washers	200.00	500.00	200.00
1,500 lb. wrought-iron or steel pipe for sub. charges except pipe for electric conduits	18	20	20
760 lin.ft. galvanized-iron electric conduits in the tunnel, ¾ in.	35	40	65
350 lin.ft. galvanized-iron electric conduits in the tunnel, 1 in.	45	50	75
1,200 lin.ft. galvanized-iron electric conduits in the tunnel, 1¼ in.	65	60	80
50 lin.ft. galvanized-iron electric conduits in the tunnel, 2 in.	1.30	75	1.50
50 lin.ft. galvanized-iron electric conduits in the tunnel, 2½ in.	1.50	1.00	2.50
100 lin.ft. galvanized-iron electric conduits in the tunnel, 4 in.	2.00	1.50	4.00
35 galvanized-iron fixtures, outlet boxes (3½ x 3½ x 1½ in).	2.00	1.50	3.00
5 galvanized-iron fixtures, pull boxes (4 x 4 x 3 in.)	3.00	5.00	4.00
6 galvanized-iron fixtures, pull boxes (6 x 10 x 4 in.)	6.00	7.00	12.00
6 galvanized-iron fixtures, pull boxes (8 x 12 x 4 in.)	8.00	10.00	15.00
2,500 lb. curb guards, ladders and miscellaneous fixtures	25	20	12
16 boxes for lights in the tunnel	12.00	25.00	15.00
20 ton furnishing cast-iron hub and spigot pipe for sub. surface charges (straight pipe)	75.00	100.00	125.00
1 ton furnishing cast-iron hub and spigot pipe for sub. surface charges (special castings)	175.00	200.00	250.00
1.6 ton new C. I. manhole and catch basin fixtures, etc., and castings not otherwise provided for	200.00	200.00	250.00
10 cast-iron exhaust air ports type A-6	18.00	100.00	50.00
100 lin.ft. cast-iron water discharge or other tunnel service pipe 4 in.	1.75	1.20	2.50
750 lin.ft. cast-iron water discharge or other tunnel service pipe 6 in.	2.50	1.50	3.00
225 lin.ft. cast-iron water discharge or other tunnel service pipe 8 in.	3.25	4.00	4.00
100 lb. miscellaneous bronze fixtures	1.00	1.50	1.00
100 lb. miscellaneous brass fixtures	1.00	1.50	1.00
5,000 duct. ft. tunnel ducts, single way	.30	.30	.30
50 duct.ft. tunnel ducts, 4 in. fibre	.30	1.00	.50
25 sq.ft. asbestos lumber ¼ in.	1.00	.40	1.00
500 lin.ft. changing cast-iron water pipe 6 in.	1.75	3.00	5.00
500 lin.ft. changing gas pipe 6 in.	1.75	5.00	5.00
800 lin.ft. changing W. I. Steel or fibre conduits 3 in.	.50	1.50	.50
50 lin.ft. laying vitrified pipe sewers, 12 in.	3.50	5.00	6.00
580 lin.ft. laying vitrified pipe sewers, 15 in.	4.50	6.00	6.00
270 lin.ft. laying vitrified pipe sewers, 20 in.	8.50	8.00	7.00
10 lin.ft. laying cast-iron pipe sewers, 12 in.	2.50	3.00	10.00
40 lin.ft. laying cast-iron pipe sewers, 16 in.	3.00	4.00	10.00
1,400 lin.ft. building tight board fence	3.00	2.10	2.00
700 lin.ft. building temporary wooden rail fence	1.00	1.00	1.00
50 sq.yd. restoration of granite block pavement	5.00	3.00	5.00
1,500 sq.ft. temporary restoration and maintenance of granite block pavement	4.00	2.50	4.00
300 sq.ft. restoration of sidewalk	3.00	3.00	3.00
1,200 sq.ft. temporary restoration and maintenance of sidewalks	3.00	2.50	2.00
500 lin.ft. restoration of curbing	1.00	1.50	3.00
250 sq.yd. new granite block pavement	8.00	4.00	6.00
500 sq.yd. new cement sidewalk	3.00	3.60	3.00
250 lin.ft. new granite curbing	4.50	4.00	7.50
Extended totals	$301,312	$429,591	$465,591

Weekly Construction Market

PRICE declines in the South and West on such materials as, c.-i. pipe, cement and hollow tile are being immediately offset by advances in structural rivets and steel pipe occurring along the Atlantic seaboard. Three out of five changes in this week's linseed oil quotations are also advances. Thus it is seen that the current building materials market is not necessarily a falling one, although weak in spots.

One instance of weakness is the case of c.-i. pipe. Since February, 1924, this material has been coming into the United States from foreign countries in substantial tonnages. At that time the Water Department of the city of Pasadena, Calif., imported 1,000 tons from the Pont au Mousson works in France. During the past week orders have been reported for 15,600 tons of imported c.-i. pipe for various municipalities in New York and New Jersey.

To offset this condition comes a report to *E.N.-R.* to the effect that approximately 6,800 gross tons of steel, shipped to Mobile, Ala., via the Warrior River barge line, made up the cargo of the British steamer King Gruffy, which sailed March 4 for ports in South Africa. The cargo consisted mostly of steel rails from Ensley, Birmingham, Prattville and Fairfield. About 13,845 rails and a quantity of barbed wire will be discharged at Cape Town, Algoa Bay, East London and Port Natal.

The building situation, as measured by permits issued, shows a declining trend in the New York and Los Angeles districts and considerable gains in the vicinity of St. Louis and Tacoma, Wash., compared with this time last year.

There is little unemployment in the Eastern section of the country compared with the depressed conditions that have prevailed during most of the winter in the Northwest. Lumber mills, there, are still on a 5-day week basis. Demand is beginning to revive for building trades mechanics, farm hands, miners and workers for the Alaska canneries. Road and bridge construction are showing increasing activity in the Northwestern states.

	New York	Atlanta	Dallas	Chicago	Minneapolis	Denver	San Francisco	Seattle	Montreal
Steel Products									
Structural shapes, 100 lb.	$3.34	$3.90	$4.15	$3.10	$3.35	$3.07½	$3.15	$3.35	$4.25
Structural rivets, 100 lb.	+4.50	4.45	4.75	3.50	3.75	4.65	5.00	3.80	6.00
Reinforcing bars, ¾ in. up, 100 lb.	3.24	3.40	3.38	3.00	3.25	3.87½	3.35	3.25	2.30
Steel pipe, black, 3½ to 6 in. lap, discount	48%	+53.2%	43%	56½%	54.25%	36%	44.7@55.5%	45%	59.49
Cast-iron pipe, 6 in. and over, ton	54.60@55.60	—56.00	56.00	49.20@50.20	55.50	62.00	53.00	—55.00	60.00
Concreting Material									
Cement without bags, bbl.	2.50@2.60	—2.30	2.05	2.20	2.42	2.84	—2.31	2.65	1.80
Gravel, ¾ in., cu.yd.	1.75	1.90	2.38	3.00	1.65	1.90	2.15	1.50	1.25
Sand, cu.yd.	1.25	1.40	2.00	3.00	1.25	1.00	1.50	1.50	1.25
Crushed stone, ¾ in., cu.yd.	1.85	2.00	2.83	3.00	1.75	2.50	2.15	3.00	2.25
Miscellaneous									
Pine, 3x12 to 12x12, 20 ft. and under, M.ft.	60.00	34.00	56.00	55.00	39.75	—35.75	+30.00	23.50	60.00
Lime, finishing, hydrated, ton	18.20	22.50	20.00	20.00	23.00	24.00	22.00	24.00	21.00
Lime, common, lump, per bbl.	2.50@2.75	1.45	1.85	1.26	1.35	2.70	1.60	2.80	10.50
Common brick, delivered, 1,000	18.00	10.50	12.10	12.00	13.50	12.00	15.50	14.50	17.50
Hollow building tile, 4x12x12, per block	Not used	—.0808	.0941	.06	.07	.085	.....	.11	.12
Hollow partition tile 4x12x12, per block	.1162	—.0808	.0941	.06	.....	.085	.108	.11	.10
Linseed oil, raw, 5 bbl. lots, gal.	—1.21	+1.25	1.30	1.25	+1.26	—1.35	+1.34	1.12	1.11
Common Labor									
Common labor, union, hour	.75	.30	.....	.82½	.....	.50@.55	.55	.62½	.....
Common labor, non-union, hour	.....	.25	.30@.50	.75	.50@.55	.35@.50	.50	.50	.20@.25

Explanation of Prices—Prices are to contractors in carload lots unless other quantities are specified. Increases or decreases from previous quotations are indicated by + or — signs. For steel pipe, the prevailing discount from list price is given; 45-5% means a discount of 45 and 5 per cent.

New York quotations delivered, except sand, gravel and crushed stone, alongside dock; common lump lime, in 280-lb. bbl. net, and hydrated lime f.o.b. cars; tile "on trucks"; linseed oil and cast-iron pipe f.o.b.

Labor—Concrete laborers' rate, 93¾c.; building laborers, 75c.; excavating laborers, 62½c. per hr.

Chicago quotes hydrated lime in 50-lb. bags; lump finishing lime per 180-lb. net. Lumber, sand, gravel and stone delivered on job.

Minneapolis quotes on fir instead of pine. Brick, sand and hollow tile delivered. Cement on cars. Gravel and crushed stone quoted at pit. We quote on brown lime per 180-lb. net; white is $1.60 for Kelly Island and Sheboygan. Common labor not organized.

THIS limited price list is published weekly for the purpose of giving current prices on the principal construction materials, and of noting important price changes on the less important materials. Moreover, only the chief cities are quoted.

Valuable suggestions on costs of work can be had by noting actual biddings as reported in our Construction News section.

The first issue of each month carries complete quotations for all construction materials and for the important cities. The last complete list will be found in the issue of March 5, the next on April 2.

Denver quotes on fir instead of pine. Cement "on tracks"; gravel and sand at pit; stone on cars; lime, brick, hollow tile and lumber on job. Tile price is at warehouse. Linseed oil, delivered in wooden bbl. Common lump lime per 0-lb. net.

Atlanta quotes sand, stone and gravel per ton instead of cu.yd. Common lump lime per 180-lb. net.

Dallas quotes lime per 180-lb. bbl. Steel, cement, cast-iron pipe and crushed stone f.o.b. cars, other materials delivered.

San Francisco quotes on Heath tile, size 5½ x 8 x 11½. Prices are all f.o.b. warehouses except C. I. pipe, which is mill price plus freight to railway depot at any terminal. Common lump lime per 180-lb. net. Lumber prices are to dealers in yards at San Francisco, for No. 1 fir, common.

Seattle quotes on Douglas fir (delivered) instead of pine. Lump finishing lime per 180-lb. net. Brick and hollow building tile delivered. Hydrated lime in paper sacks. Sand and gravel at bunkers.

Montreal quotes on pine lumber. Sand stone, gravel and lump lime per ton. Stone, lime and tile are delivered; sand, gravel and cement on siding; brick f.o.b. plant; steel and pipe at warehouse. Hollow tile per ft. Cement price is in Canadian funds (the Canadian dollar stands at 99.87). Bag charge is 80c. per bbl. Discount of 10c. per bbl. for payment within 20 days from date of shipment. Steel pipe per 100 ft. net; 3½-in., $59.49.